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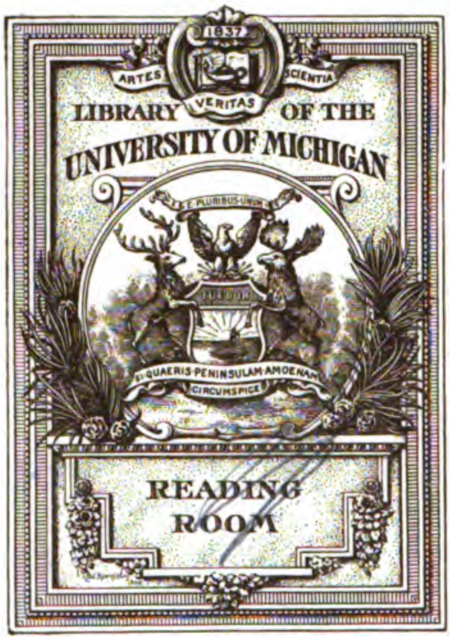
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CYCLOPEDIA OF AMERICAN HORTICULTURE

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Plate XX. Various types of garden Narcissus.

CYCLOPEDIA OF AMERICAN HORTICULTURE

106133

COMPRISING SUGGESTIONS FOR CULTIVATION OF HORTICULTURAL PLANTS, DESCRIPTIONS OF THE SPECIES OF FRUITS, VEGETABLES, FLOWERS AND ORNAMENTAL PLANTS SOLD IN THE UNITED STATES AND CANADA, TOGETHER WITH GEOGRAPHICAL AND BIOGRAPHICAL SKETCHES

Liberty Hyde
BY
L. H. BAILEY
Professor of Horticulture in Cornell University

ASSISTED BY
WILHELM MILLER, PH.D.
Associate Editor
AND MANY EXPERT CULTIVATORS AND BOTANISTS

Illustrated with over
Two Thousand Original Engravings

IN FOUR VOLUMES
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The asterisk designates the contributors to the third volume. Many of the contributors have also assisted in reading proofs and in other ways.

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*ANDREWS, D. M., Nurseryman, Boulder, Colo. (*Œnothera. Opuntia. Native western plants, especially hardy Cacti.*)

ARCHDEACON & Co., Commission merchants, New York, N. Y. (*Mushroom.*)

ARNOLD, Jr., GEO., Florist, Rochester, N. Y. (*China Aster.*)

*ATKINS, F. L., Florist, Rutherford, N. J. (*Platycerium.*)

ATKINSON, GEO. F., Prof. of Botany, Cornell Univ., Ithaca, N. Y. (*Mushroom.*)

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*BARCLAY, F. W., Gardener, Haverford, Pa. (*Botany and cultivation of Herbaceous Perennials.*)

BARNES, CHARLES R., Prof. of Plant Physiology, Univ. of Chicago, Chicago, Ill. (*Fertilization. Flower. Teratology. Has read many proofs of physiological subjects.*)

BARNES, WILLIAM H., Secretary Kans. State Hort. Soc., Topeka, Kans. (*Kansas.*)

BAYERSDORFER, H., Dealer in florists' supplies, Philadelphia, Pa. (*Everlasting flowers.*)

BEACH, Prof. S. A., Horticulturist, N. Y. Exp. Sta., Geneva, N. Y. (*Corn. Thinning.*)

BEADLE, C. D., Botanist and horticulturist, Biltmore, N. C. (*Bamboo.*)

BEAL, Prof. W. J., Mich. Agric. College, Agricultural College, Mich. (*Grass. Has read proofs of many genera of grasses.*)

BECKERT, THEO. F., Florist, Allegheny City, Pa. (*Bougainvillæa.*)

*BERCKMANS, P. J., Pomologist and nurseryman, Augusta, Ga. (*Lawns for the South. Magnolia. Melia. Michelia. Persimmon. Pomegranate. Has read proof of many groups of importance in the South.*)

*BESSEY, CHARLES E., Prof. of Botany, Univ. of Nebr., Lincoln, Nebr. (*Plant. Trees for the Plains. Has read several articles on grasses and native plants.*)

BLAIR, Prof. J. C., Horticulturist, Ill. Exp. Sta., Champaign, Ill. (*Greenhouse Glass. Illinois.*)

*BRANDEGEE, Mrs. KATHARINE, Botanist, editor of Zoë, San Diego, Calif. (*Several genera of Cacti, as Mammillaria, Melocactus, Pelecyphora, Pereskia, Phyllocactus, Pilocereus, Rhipsalis.*)

*BRANDEGEE, T. S., Botanist, San Diego, Calif. (*Nolina.*)

*BRAUNTON, ERNEST, Landscape gardener, Los Angeles, Calif. (*Nerium, Palms, Phœnix, Pittosporum, and other plants cultivated in California.*)

BRUCKNER, NICHOL N., Dreer's Nursery, Riverton, N. J. (*The article "Fern." Many groups of tender ferns.*)

BUDD, J. L., Prof. Emeritus of Horticulture, Iowa Agric. Coll., Ames, Ia. (*Roses for the Prairie States. Has read proof of Iowa and of articles on important fruits.*)

BUFFUM, Prof. B. C., Horticulturist, Wyo. Exp. Sta., Laramie, Wyo. (*Wyoming.*)

*BURBANK, LUTHER, Plant-breeder, Santa Rosa, Calif. (*Nicotunia. Has read proofs of Gladiolus, etc.*)

BURNETTE, Prof. F. H., Horticulturist, La. Exp. Sta , Baton Rouge, La. (*Louisiana.*)

*BURRILL, T. J., Prof. of botany and horticulture, Univ. of Ill., Urbana, Ill. (*Protoplasm.*)

*BUTZ, Prof. GEO. C., Horticulturist, Pa. Exp. Sta., State College, Pa. (*Carnation. Pennsylvania.*)

*CAMERON, ROBERT, Gardener, Botanic Garden of Harvard Univ., Cambridge, Mass. (*Various articles and much help on rare plants. Alpinia, Campanula, Echinocactus, Nemophila, Primula, etc.*)

*CANNING, EDWARD J., Gardener, Smith College, Botanic Gardens, Northampton, Mass. (*Many articles and much help on rare and difficult plants. Anthurium. Echinocactus. Epiphyllum. Gloxinia. Peat. Puya.*)

CARD, Prof. FRED W., Horticulturist, R. I. Exp. Sta., Kingston, R. I. (*Nebraska. Botany and culture of bush-fruits, as Amelanchier, Berberis, Blackberry, Buffalo Berry, Currant, Loganberry, Raspberry.*)

Clinkaberry, Henry T., Gardener, Trenton, N. J. (*Certain orchids, as Lælia.*)

*Coates, Leonard, Fruit-grower, Napa City, Calif. (*Olive. Orange. Has helped on other fruits.*)

*Cockerell, T. D. A., Entomologist, East Las Vegas, N. M. (*New Mexico.*)

*Collins, John S., Fruit-grower, Moorestown, N. J. (*Pear.*)

*Conard, Henry S., Fellow in Botany, Univ. of Pa., Philadelphia, Pa. (*Nymphæa.*)

*Cook, O. F., Special Agent for Tropical Agriculture, Div. of Botany, Dept. of Agric., Washington, D. C. (*Coffee. Paritium. Help on Porto Rico.*)

Corbett, Prof. L. C., Horticulturist, W. Va. Exp. Sta., Morgantown, W. Va. (*West Virginia.*)

*Coulston, Mrs. M. B., Formerly assistant editor of Garden and Forest, Ithaca, N. Y. (*Various native plants.*)

Coulter, John M., Professor and Head of the Dept. of Botany, Univ. of Chicago, Chicago, Illinois. (*Echinocactus.*)

*Cowell, Prof. John F., Dir. Buffalo Botanic Garden, West Seneca, N. Y. (*Odontoglossum. Phormium.*)

Cowen, J. H., formerly Assistant in Horticulture, Colo. Exp. Sta., died 1900. (*Certain Colorado plants, as Lepachys, Leucocrinum. Verbena.*)

*Craig, John, Prof. of Extension Teaching in Agric., Cornell Univ., Ithaca, N. Y. (*Canada. Gooseberry. Kale. Kohlrabi. Pomology. Quince. Rape.*)

Craig, Robert, Florist, Philadelphia, Pa. (*Araucaria. Ardisia. Codiæum.*)

Craig, W. N., Gardener, North Easton, Mass. (*Mushroom.*)

Crandall, Prof. C. S., Div. of Forestry, U. S. Dept. Agric., Washington, D. C. (*Colorado.*)

*Culbertson, H., El Cajon Packing Co., El Cajon, Calif. (*Peach.*)

Cushman, E. H., Gladiolus specialist, Sylvania, Ohio. (*Gladiolus.*)

*Darlington, H. D., Wholesale florist, specialist in heaths and hard-wooded plants, Flushing, N. Y. (*Epacris. Leptospermum. Pimelea. Has read proof of many articles on hard-wooded plants.*)

*Davis, K. C., Botanist, State Normal School, St. Cloud, Minn. (*All genera in Ranunculaceæ, e. g., Clematis, Nigella, Pæonia, Ranunculus.*)

*Davy, J. Burtt, Asst. Botanist, Univ. of Calif. Exp. Sta., Berkeley, Calif. (*Acacia. Callistemon. Eugenia. Eucalyptus. Maytenus. Various Myrtaceæ. Pittosporum. Psidium.*)

*Dean, James, Florist, Bay Ridge, N. Y. (*Nephrolepis.*)

Deane, Walter, Botanist, Cambridge, Mass. (*Herbarium. Has helped on various botanical problems.*)

*Dewey, Lyster H., Div. of Botany, Dept. of Agric., Washington, D. C. (*Mentha. Phytolacca.*)

Dorner, Fred, Carnation specialist, Lafayette, Ind. (*Carnation.*)

Dorsett, P. H., Associate Physiologist and Pathologist, Dept. of Agric., Washington, D.C. (*Violet.*)

*Douglas, Thos. H., of R. Douglas' Sons, nurserymen and specialists in conifers, Waukegan, Ill. (*Larix. Picea. Pseudotsuga.*)

*Drew, E. P., Manager Rocky River Nursery, Clifton Park, O. (*Picea.*)

*Duggar, B. M., Asst. Prof. of Botany (Plant Physiology), Cornell Univ., Ithaca, N. Y. (*Photosynthesis. Physiology of Plants. Pollen.*)

Dunning, D. M., Amateur, Auburn, N.Y. (*Grapes under Glass.*)

Dupuy, Louis, Wholesale florist and specialist in hard-wooded plants, Whitestone, L. I. (*Erica. Has read other articles on heath-like plants.*)

*Earle, Prof. F. S., Horticulturist, Ala. Polytechnic Institute, Auburn, Ala. (*Alabama. Packing.*)

*Earle, Parker, Horticulturist, Roswell, N. M. (*New Mexico.*)

Egan, W. C., Amateur, Highland Park, Ill. (*Eremurus. Has helped on hardy plants.*)

*Eisele, Jacob D., Manager of Dreer's Nursery, Riverton, N. J. (*Cordyline. Pandanus. Has read proofs of several important subjects.*)

Elliott, William H., Florist, Brighton, Mass. (*Asparagus plumosus.*)

Emery, S. M., Manhattan, Mont. (*Montana.*)

Endicott, John, Bulb-grower, Canton, Mass. (*Littonia.*)

Endicott, W. E., Teacher, Canton, Mass. (*Achimenes. Acidanthera. Ixia. Has made important corrections in many articles on bulbs.*)

Evans, Walter H., Office of Exp. Stations, Dept. of Agric., Washington, D. C. (*Alaska.*)

Fawcett, Wm., Director Dept. Public Gardens and Plantations, Kingston, Jamaica. (*Tropical fruits, as Cherimoya, Marmalade Plum, Egg Fruit, Mango, Mangosteen, and others.*)

*Fernow, Prof. B. E., Director College of Forestry, Cornell Univ., Ithaca, N. Y. (*Conifers. Forestry. Pine.*)

Finlayson, Kenneth, Gardener, Brookline, Mass. (*Diosma.*)

*Fletcher, Prof. S. W., Horticulturist, Wash. Ex. Sta., Pullman, Wash. (*Ipomœa and various other Convolvulaceæ. Helianthus and related genera. Nemophila. Nierembergia. Nolana. Pollination.*)

*Foord, J. A., Asst. in Dairy Husbandry, Cornell Univ., Ithaca, N. Y. (*New Hampshire.*)

*Franceschi, Dr. F., Manager S. Calif. Acclimatizing Ass'n, Santa Barbara, Calif. (*Rare plants grown in S. Calif., as Dasylirion, Flacourtia, Fouquiera, Furcræa, Hazardia, Parkinsonia, etc. Has read many proofs and made numerous corrections.*)

Galloway, B. T., Dir. of Office of Plant Industry, U. S. Dept. of Agric., Washington, D. C. (*Floriculture. Has read various important articles.*)

*Gannett, Frank E., Editor, "The News," Ithaca, N. Y.; formerly Sec'y to President of the U. S. Philippine Commission. (*Philippine Islands.*)

*Garcia, Fabian, Horticulturist and Asst. Prof. of Horticulture, College of Agr. and Mechanic Arts, Mesilla Park, N. M. (*New Mexico.*)

Garfield, Chas. W., Horticulturist, Grand Rapids, Mich. (*Michigan.*)

*Gerard, J. N., Amateur, Elizabeth, N. J. (*Many articles, especially on bulbous plants, as Crocus, Iris, Muscari, Narcissus.*)

Gillett, Edward, Nurseryman, Southwick, Mass. (*Hardy Ferns. Liparis. Has read numerous proofs on native plants.*)

Goff, Prof. E. S., Horticulturist, Wis. Exp. Sta., Madison, Wis. (*Wisconsin.*)

Gould, H. P., Acting Entomologist and Asst. Horticulturist, Md. Exp. Sta., College Park, Md. (*Brussels Sprouts. Celeriac.*)

*Gould, Mrs. Thos., Petunia specialist, Ventura, Calif. (*Petunia.*)

Green, Prof. S. B., Horticulturist, Minnesota Exp. Sta., St. Anthony Park, Minn. (*Minnesota.*)

*Green, Wm. J., Horticulturist, Ohio Exp. Sta., Wooster, Ohio. (*Ohio. Greenhouse sub-irrigation.*)

Greene, Edward L., Prof. of Botany, Catholic Univ. of America, Washington, D. C. (*Dodecatheon.*)

Greenlee, Miss Lennie, Bulb-grower, Garden City, N. C. (*Ixia.*)

*Greiner, T., Specialist in vegetables, La Salle, N. Y. (*Garden vegetables, as Artichoke, Asparagus, Bean, Cress, Corn Salad, Kohlrabi, Lettuce, Onion, Parsley, Parsnip.*)

*Grey, Robert M., Gardener, North Easton, Mass. (*Numerous important orchid groups, as Cypripedium, Epidendrum, Lycaste, Maxillaria, Masdevallia, Odontoglossom, Oncidium, Orchid, Phalænopsis.*)

Groff, H. H., Gladiolus specialist, Simcoe, Ont. (*Gladiolus.*)

Gurney, James, Gardener, Mo. Botanical Garden, St. Louis, Mo. (*Cacti.*)

*Hale, J. H., Nurseryman and pomologist, South Glastonbury, Conn. (*Connecticut. Peach.*)

Halsted, Prof. B. D., Rutgers College, New Brunswick, N. J. (*Diseases. Fungus.*)

Hansen, Geo., Landscape architect and botanist, Berkeley, Calif. (*Epidendrum.*)

Hansen, Prof. N. E., Horticulturist, S. Dak. Exp. Sta., Brookings, S. Dak. (*South Dakota.*)

Harris, Frederick L., Gardener, Wellesley, Mass. (*Lisianthus. Medinilla.*)

*Harris, W., Acting Dir. Dept. Public Gardens and Plantations, Kingston, Jamaica. (*Mammee Apple, Persea, Pomelo and other tropical fruits.*)

Harris, W. K., Florist, Philadelphia, Pa. (*Ficus elastica. Help on Lilium Harrisii.*)

*Harrison, C. S., Nurseryman, York, Neb. (*Pseudotsuga.*)

*Hasselbring, Heinrich, First Asst. Horticulturist, N. Y. Exp. Sta., Geneva, N. Y. (*Iris, and most orchids from Gongora to Zygopetalum.*)

Hastings, G. T., formerly Asst. in Botany, Cornell Univ., Ithaca, N. Y.; now Science Teacher, Santiago, Chile. (*Some tropical plants, as Berria, Bertholletia. A few grasses, as Hierochloe, Holcus, Hordeum.*)

*Hatfield, T. D., Gardener, Wellesley, Mass. (*Numerous and varied contributions, as Gesnera, Gloxinia, Lachenalia, Leea, Macrozamia, Œnothera, Oxalis, Pelargonium.*)

*Hedrick, U. P., Asst. Prof. of Horticulture, Agricultural College, Mich. (*Evaporation of Fruit. Prune.*)

*Henderson & Co., Peter, Seedsmen, New York, N. Y. (*Bulbs. Eccremocarpus. Polianthes. Much proof and many suggestions.*)

*Henderson, Prof. L. F., Botanist, Idaho Exp. Sta., Moscow, Idaho. (*Phacelia.*)

Herrington, A. H., Gardener, Florham Farms, Madison, N. J. (*Chrysanthemum coccineum. Hollyhock.*)

*Hews, A. H. Manufacturer of earthen ware, North Cambridge, Mass. (*Pots.*)

Hexamer, Dr. F. M., Editor "American Agriculturist," New York, N. Y. (*Several biographical sketches, as Fuller, Harris, Thurber.*)

Hicks, G. H., late of U. S. Dept. of Agric., Washington, D. C. (deceased). (*Seed-testing.*)

Hicks, Henry, Nurseryman, Westport, L. I. (*Ligustrum.*)

Higgins, J. E., Horticulturist and teacher, Honolulu, H. I. (*Hawaiian Islands.*)

Hill, E. G., Florist, Richmond, Ind. (*Begonia.*)

*Hitchcock, A. S., Asst. Chief, Div. of Agrostology, U. S. Dept. Agric., Washington, D. C. (*Most of the genera of grasses from E to Z.*)

Hollister, E. J., Specialist in celery culture, Holley, Colo. (*Celery.*)

Hoopes, Josiah, Nurseryman, West Chester, Pa. (*Hedges.*)

Horsford, Fred H., Nurseryman and specialist in Lilies, Charlotte, Vt. (*Alpine Gardens. Lilium. Has read proof of many articles on native plants and hardy herbaceous perennials.*)

Hunn, Charles E., Gardener, Cornell Exp. Sta., Ithaca, N. Y. (*Forcing of Vegetables. Mignonette. Strawberry.*)

Huntley, Prof. F. A., Horticulturist, Idaho Exp. Sta., Moscow, Idaho. (*Idaho.*)

Hutchins, Rev. W. T., Sweet Pea specialist, Springfield, Mass. (*Sweet Pea.*)

*Irish, H. C., Horticulturist, Mo. Botanical Garden, St. Louis, Mo. (*Capsicum. Lactuca. Pepper.*)

Jackson & Perkins Co., Nurserymen and specialists in Clematis, Newark, N. Y. (*Clematis.*)

*Jaenicke, Adolph, Manager propagating dept., J. L. Childs, Floral Park, N. Y. (*Primula.*)

*Jeffers, A., Editor "Cornucopia," Norfolk, Va. (*Kale. Potato.*)

*Jordan, A. T., Asst. Horticulturist, New Brunswick, N. J. (*New Jersey.*)

Junghanns, R. L., Poughkeepsie, N. Y. (*Reseda.*)

*Kains, M. G., Horticulturist, School of Practical Agric. and Hort., Briar Cliff Manor, N. Y. (*Minor vegetables, as Horse-Radish and Okra. Herbs, as Hyssopus, Origanum; also Ginseng and Glycyrrhiza.*)

Kearney, T. H., Div. of Veg. Phys. and Path., Dept. of Agric., Washington, D. C. (*Three orchid genera, Grammangis, Grammatophyllum, Habenaria.*)

*Keller, J. B., Florist, Rochester, N. Y. (*Many groups of hardy herbaceous perennials. Article on Herbaceous Perennials.*)

*Kelsey, Harlan P., Landscape architect, Boston, Mass. (*North Carolina plants, as Galax, Leucothoë and Paronychia.*)

Kennedy, P. Beveridge, Horticulturist, Nev. Exp. Sta., Reno, Nev. (*Many genera of grasses in Vols. I and II. Begonia.*)

Kerr, J. W., Nurseryman, Denton, Md. (*Maryland. Help on Plum.*)

Kift, Robert, Florist, Philadelphia, Pa. (*Cut-flowers.*

Kinney, L. F., Horticulturist, Kingston, R. I. (*Celery.*)

*Knapp, Dr. S. A., Special commission U. S. Dept. Agric., Lake Charles, La. (*Philippine Islands.*)

Lager & Hurrell, Orchid cultivators, Summit, N. J. (*Cattleya.*)

*Lager, John E., Orchid specialist, Summit, N. J. (*Oncidium.*)

*Lake, Prof. E. R., Horticulturist, Ore. Exp. Sta., Corvallis, Ore. (*Oregon.*)

Landreth, Burnet, Seedsman, Philadelphia, Pa. (*David Landreth.*)

Lauman, G. N., Instructor in Hort., Cornell Univ., Ithaca, N. Y. (*Geranium. Impatiens.*)

*Lewers, Ross, Fruit-grower, Franktown, Nev. (*Nevada.*)

Lonsdale, Edwin, Florist, Wyndmoor, Philadelphia, Pa. (*Conservatory.*)

Lord & Burnham Co., Horticultural architects and builders, Irvington-on-Hudson, N. Y. (*Greenhouse Construction.*)

Lothrop & Higgins, Dahlia specialists, East Bridgewater, Mass. (*Dahlia.*)

*Lyon, T. T., Pomologist, South Haven, Mich., (Died 1900). (*Pear.*)

*McFarland, J. Horace, Horticultural printer and expert in photography, Harrisburg, Pa. (*Border. Photography.*)

*McKay, Prof. A. B., Prof. of Horticulture and Station Horticulturist, Miss. Exp. Sta., Agricultural College, Miss. (*Potato.*)

McMillen, Robert, Wholesale grower of mignonette, Pearl River, N. Y. (*Mignonette.*)

McWilliam, Geo., Gardener, Whitinsville, Mass. (*Dipladenia. Luculia.*)

*Macomber, J. T., Fruit-grower, Grand Isle, Vt. (*Peach.*)

MacPherson, James, Landscape gardener, Trenton, N. J. (*Euphorbia. Has read proofs of several orchid genera.*)

*Manning, J. Woodward, Horticultural expert and purchasing agent, Boston, Mass. (*Pachysandra. Pyrethrum. Hardy herbs. Has read proofs of many groups of perennials.*)

Manning, Warren H., Landscape architect, Boston, Mass. (*Herbaceous Perennials. Rock Gardens.*)

Mason, Prof. S. C., Dept. of Horticulture and Forestry, Berea College, Berea, Ky. (*Labeling. Layering.*)

*Massey, Prof. W. F., Horticulturist, N. C. Exp. Sta., Raleigh, N. C. (*Fig. North Carolina.*)

Mathews, Prof. C. W., Horticulturist, Ky. Exp. Sta., Lexington, Ky. (*Kentucky.*)

Mathews, F. Schuyler, Artist, Boston, Mass. (*Color.*)

*Mathews, Wm., Florist and orchid grower, Utica, N. Y. (*Various rare and important orchids, as Gongora, Grammatophyllum, Ionopsis, Limatodes, Miltonia, Pholidota.*)

Maynard, Prof. S. T., Prof. of Horticulture, Mass. Agr. Coll., and Horticulturist, Mass. Hatch Exp. Sta., Amherst, Mass. (*Massachusetts.*)

*Mead, T. L., Horticulturist, Oviedo, Fla. (_Crinum. Orange. Has helped in matters of extreme southern horticulture._)

Meehan, Joseph, Nurseryman, Germantown, Philadelphia, Pa. (_Idesia._)

Meredith, A. P., Gardener, South Lancaster, Mass. (_Humea._)

*Mische, Emil, Asst. to Olmsted Bros., Landscape Architects, Brookline, Mass. (_Quisqualis._)

*Moon, Samuel C., Nurseryman, Morrisville, Pa. (_Oak. Trees for ornament._)

*Morrill, Roland, Fruit-grower, Benton Harbor, Mich. (_Peach._)

*Morris, O. M., Associate Horticulturist, Okla. Exp. Sta., Stillwater, Okla. (_Indian Territory Oklahoma._)

Munson, T. V., Nurseryman and grape hybridist, Denison, Tex. (_Grape culture in the South._)

Munson, Prof. W. M., Horticulturist, Me. Exp. Sta., Orono, Me. (_Maine. Vaccinium._)

*Nehrling, H., Milwaukee, Wis. (_Phœnix. Has helped on other plants cultivated in his garden at Gotha, Fla._)

*Newbury, H. E., Specialist in tuberose culture, Magnolia, N. C. (_Polianthes._)

*Newell, A. J., Gardener, Wellesley, Mass. (_Certain orchids_, e.g., _Odontoglossum._)

*Norton, J. B. S., Botanical Assistant, Mo. Botanical Garden, St. Louis, Mo. (_Genera of Euphorbiaceæ. Phyllanthus. Numerous botanical puzzles._)

Ogston, Colin, Gardener and orchid cultivator, Kimball Conservatories, Rochester, N. Y. (_Dendrobium._)

*Oliver, G. W., Div. of Gardens and Grounds, U. S. Dept. Agric., Washington, D. C. (_Many articles on palms, aroids, succulents and rare plants, and much help on proofs. Alstrœmeria. Amaryllis. Nepenthes. Ochna. Pennisetum. Petrea. Sarracenia._)

*Olmsted, Jr., F. L., Landscape architect, Brookline, Mass. (_Park._)

*O'Mara, Patrick, of Peter Henderson & Co., New York, N. Y. (_Potting. Has read various important articles, suggested contributors and given other help._)

Orpet, Edward O., Gardener, So. Lancaster, Mass. (_Many articles. Border. Cyclamen. Dianthus, and certain orchids._)

Parsons, Jr., Samuel, Landscape architect, New York, N. Y. (_Lawn._)

Peacock, Lawrence K., Dahlia specialist, Atco, N. J. (_Dahlia._)

*Pennock, F. M., Horticulturist, San Juan, Porto Rico. (_Porto Rico._)

*Peterson, Wm. A., of the firm of P. S. Peterson & Son, Nurserymen, Chicago, Ill. (_Pæonia._)

Powell, Prof. G. Harold, Horticulturist, Del. Exp. Sta., Newark, Del. (_Cherry. Delaware. Help on Peach, etc._)

*Powell, George T., Dir. School of Practical Agriculture and Horticulture, Briar Cliff Manor, N. Y. (_Pear. Has read proofs of other important fruits._)

Price, Prof. R. H., Horticulturist, Tex. Exp. Sta., College Station, Tex. (_Texas._)

*Prince, L. B., Pres. Board of Regents, New Mex. Exp. Sta., Mesilla Park, N. M. (_Prince._)

Purdy, Carl, Specialist in California bulbs, Ukiah, Calif. (_California native plants, as Brodiæa, Calochortus, Erythronium, Fritillaria._)

*Rane, Prof. F. W., Horticulturist and Prof. of Horticulture, N. H. College, Durham, N. H. (_New Hampshire._)

Rawson, Grove P., Florist, Elmira, N. Y. (_Lantana._)

Rawson, W. W., Seedsman and market-gardener, Boston, Mass. (_Cucumber. Lettuce._)

*Reasoner, E. N., Nurseryman and horticulturist, Oneco, Fla. (_Many articles, and much help on extreme southern horticulture. Cæsalpinia. Cocos. Guava. Kumquat. Lemon. Lime. Mango. Musa. Orange._)

*Rehder, Alfred, Asst. at the Arnold Arboretum, Jamaica Plain, Mass. (_Botany and culture of most of the hardy trees and shrubs._)

*Roberts, Prof. I. P., Dir. College of Agric., Cornell Univ., Ithaca, N. Y. (_Drainage. Fertility. Manure. Potato._)

*Rolfs, Prof. P. H., Botanist, S. C. Exp. Sta., Clemson College, S. C. (_Eggplant. Florida. Okra. Onion. Pineapple._)

*Rose, J. N., Asst. Curator, U. S. Nat. Herb., Smithsonian Institution, Washington, D. C. (_Agave. Prochnyanthes._)

Rose, N. Jonsson, Landscape Gardener, Dep't. of Park, New York, N. Y. (_Various exotics._)

Roth, Filibert, Asst. Prof. of Forestry, N. Y. State College of Forestry, Cornell Univ., Ithaca, N. Y. (_Fagus._)

Rowlee, Prof. W. W., Asst. Prof. of Botany, Cornell Univ., Ithaca, N. Y. (_Definitions. Liatris. Salix._)

*Royle, Mrs. Emily Taplin, Asst. Ed. "Rural New-Yorker," New York, N. Y. (_Nepenthes._)

Sargent, Prof. C. S., Dir. Arnold Arboretum, Jamaica Plain, Mass. (_Abies. Has read proof of Picea, Prunus, etc._)

Seavey, Mrs. Frances Copley, Landscape gardener, Brighton, Ill. (_Railroad Gardening._)

*Scott, Wm., Florist, Buffalo, N. Y. (_Important florists' plants and flowers, as Acacia, Convallaria, Cyclamen, Cytisus, Smilax, Metrosideros, Peperomia, Perilla, Piqueria, etc. Also Packing Flowers._)

Scott, Wm., Gardener, Tarrytown, N. Y. (*Bertolonia and other tender foliage plants.*)

Semple, James, Specialist in China Asters, Bellevue, Pa. (*Aster.*)

Sexton, Joseph, Founder of the pampas grass industry, Goleta, Calif. (*Gynerium.*)

Shinn, Charles H., Inspector of Experiment Stations, Univ. of Calif., Berkeley, Calif. (*California, Fig, Loganberry, Sequoia, etc.*)

Shore, Robert, Head Gardener, Botanical Dept., Cornell Univ., Ithaca, N. Y. (*Various articles, as Acalypha, Bedding, Dichorisandra, Episcea, Fittonia, Hymenophyllum.*)

*Siebrecht, Henry A., Florist and nurseryman, New York and Rose Hill Nurseries, New Rochelle, N. Y. (*Much help on rare greenhouse plants, particularly orchids and palms. Dracæna. Ficus. Fuchsia. Gardenia. Ixora. Lapageria. Laurus. Nerium. Nepenthes. Puya.*)

Simonds, O. C., Landscape Gardener, Buena Ave., Chicago, Ill. (*Landscape Cemeteries.*)

Slingerland, Prof. M. V., Asst. Prof. Economic Entomology, Cornell Univ., Ithaca, N. Y. (*Insecticides. Insects.*)

Smith, A. W., Americus, Ga. (*Cosmos.*)

Smith, Elmer D., Chrysanthemum specialist, Adrian, Mich. (*Chrysanthemum.*)

*Smith, Irving C., Market-gardener, Green Bay, Wis. (*Onion. Help on Kohl-Rabi,* etc.)

*Smith, Jared G., Dir. Hawaiian Exp. Sta., Honolulu, H. I. (*Nearly all palms. Various other genera, as Centaurea, Cerastium, Cotyledon.*)

Spencer, John W., Fruit-grower, Westfield, Chautauqua Co., N. Y. (*Grapes in the North. Help on important fruits.*)

Starnes, Prof. Hugh N., Prof. of Agriculture and Horticulture, Univ. of Georgia, Athens, Ga. (*Georgia. Sweet Potato.*)

*Steele, E. S., Div. of Botany, U. S. Dept. Agric., Washington, D. C. (*Perfumery Gardening.*)

Stinson, Prof. John T., Dir. Mo. Fruit Exp. Sta., Mountain Grove, Mo. (*Arkansas.*)

Strong, Wm. C., Nurseryman, Waban, Mass. (*Kenrick.*)

*Stubbs, W. C., Dir. La. Exp. Sta., Baton Rouge, La. (*Orange.*)

*Stubenrauch, Arnold V., Fellow in Horticulture, Cornell Univ., Ithaca, N. Y. (*Olive. Plum in California. Pilocarpus. Pimelea. Platycodon.*)

*Taber, G. L., Nurseryman, Glen St. Mary, Fla. (*Persimmon.*)

Taft, Prof. L. R., Horticulturist, Mich. Agric. College, Agricultural College, Mich. (*Greenhouse Heating. Hotbeds.*)

*Taplin, W. H., Specialist in palms and ferns, Holmesburg, Philadelphia, Pa. (*Culture of many palms, ferns and foliage plants.*)

*Taylor, Frederic W., Dir. Dept. of Horticulture, Pan American Exposition, Buffalo, N. Y. (*Nebraska.*)

*Taylor, Wm. A., Asst. Pomologist, Div. of Pomology, Dept. of Agric., Washington, D. C. (*Various articles on nuts, as Hickory, Pecan.*)

Thilow, J. Otto, of H. A. Dreer, Inc., Philadelphia, Pa. (*Leek. Muskmelon.*)

Thompson, C. H., formerly Asst. Botanist, Mo. Botanical Garden, St. Louis, Mo. (*Some genera of cacti, as Echinocereus, Epiphyllum.*)

Thorburn & Co., J. M., Seedsmen, New York, N. Y. (*Hyacinth. Have read many proofs of bulbs, annuals, vegetables, herbs, etc.*)

*Toumey, Prof. J. W., Yale Forestry School, New Haven, Mass. (*Arizona. Date. Opuntia. Root-Galls.*)

Tracy, S. M., Horticulturist, Biloxi, Miss. (*Mississippi.*)

*Tracy, Prof. W. W., Seedsman, Detroit, Mich. (*Cabbage. Lettuce. Michigan. Pea. Radish.*)

*Trelease, Dr. Wm., Dir. Mo. Botanical Garden, St. Louis, Mo. (*Certain desert plants of the lily family, as Aloe, Apicra, Gasteria, Haworthia. Oxalis. Yucca.*)

*Tricker, Wm., Specialist in aquatics, Dreer's Nursery, Riverton, N. J. (*Aquarium. Most Aquatics, as Limnanthemum, Limnocharis, Nymphœa, Nelumbo, Ouvirandra, Victoria, etc.*)

*Troop, Prof. James, Horticulturist, Ind. Exp. Sta., Lafayette, Ind. (*Indiana. Persimmon.*)

Turner, Wm., Gardener, Oceanic, N. J. (*Forcing of Fruits. Mushroom.*)

Tuttle, H. B., Cranberry-grower, Valley Junction, Wis. (*Cranberry.*)

*Underwood, Prof. L. M., Columbia University, New York, N. Y. (*Botany of all ferns.*)

*Van Deman, H. E., Pomologist, Parksley, Va. (*Date. Nut Culture.*)

Vaughan, J. C., Seedsman and florist, Chicago and New York. (*Christmas Greens.*)

Vick, James, Horticulturist, Rochester, N. Y. (*Malvaviscus. Melothria.*)

Voorhees, Prof. Edward B., Dir. N. J. Exp. Sta., New Brunswick, N. J. (*Fertilizers.*)

*Waldron, Prof. C. B., Horticulturist, N. Dak. Exp. Sta., Fargo, N. Dak. (*North Dakota.*)

Walker, Prof. Ernest, Horticulturist, Ark. Exp. Sta., Fayetteville, Ark. (*Annuals. Basket Plants. Heliotrope. Watering.*)

*Ward, C. W., Wholesale florist, Queens, L. I. (*Pelargonium. Help on carnation.*)

*Watrous, C. L., Nurseryman and pomologist, Des Moines, Ia. (*Iowa. Pear.*)

Watson, B. M., Instructor in Horticulture, Bussey Inst., Jamaica Plain, Mass. (*Colchicum. Cuttage. Forcing Hardy Plants. House Plants.*)

Watts, R. L., formerly Horticulturist of Tennessee Exp. Sta. Scalp Level, Pa. (*Tennessee.*)

***Waugh**, Prof. F. A., Horticulturist, Vt. Exp. Sta., Burlington, Vt. (*Beet. Carrot. Cucumber. Greens. Lilium. Plum. Salad Plants. Vermont.*)

***Webber, Herbert J.**, In charge of Plant Breeding Laboratory, Div. of Veg. Phys. and Path., Dept. of Agric., Washington, D. C. (*Citrus. Pomelo. Murraya and other citrous genera. Plant-Breeding.*)

Wellhouse, Col. **Fred**, Fruit-grower, Fairmount, Kans. (*Kansas.*)

***Wheeler, C. F.**, Asst. Prof. of Botany, Michigan Agric. College, Mich. (*Pyrola.*)

Wheeler, H. J., Chemist, R. I. Exp. Sta., Kingston, R. I. (*Lime.*)

Whitney, Milton, Chief. Div. of Soils, Dept. of Agric., Washington, D. C. (*Irrigation. Soils.*)

Whitten, Prof. **J. C.**, Horticulturist, Mo. Exp. Sta., Columbia, Mo. (*Missouri.*)

***Whyte, R. B.**, Amateur, Ottawa, Ont. (*Hemerocallis. Lilium. Narcissus. Papaver.*)

***Wickson, Edward J.**, Prof. of Agricultural Practice, Univ. of Calif., and Horticulturist, Calif. Exp. Sta., Berkeley, Calif. (*Almond, Apricot, Cherry, Grape, Lemon, Lime, Nectarine, Pear, etc., in California.*)

***Wiegand, K. M.**, Instructor in Botany, Cornell Univ., Ithaca, N. Y. (*Coreopsis. Cordyline. Cyperus. Dracœna. Juncus. Lysimachia. Musa. Myosotis. Potentilla, Scirpus.*)

Woolson, G. C., Nurseryman, Specialist in hardy herbaceous perennials, Passaic, N. J. (*Mertensia. Has read numerous proofs.*)

Wortman, S. W., Mushroom-grower, Iselin, N. J. (*Mushroom.*)

***Wright, Charles**, Fruit-grower, Seaford, Del. (*Peach. Help on Delaware.*)

Wyman, A. P., Asst. to Olmsted Bros., Landscape Architects, Brookline, Mass. (*Dirca, Epigœa, Exochorda, Halesia, Hypericum, Kerria, Liquidambar, and other hardy trees and shrubs. Also Lathyrus, Lupinus.*)

***Yeomans, L. T.**, Fruit-grower, Walworth, N. Y. (*Pear. Help on Evaporation of Fruits.*)

***Zirngiebel, Denys**, Florist, Needham, Mass. (*Pansy.*)

II. PARTIAL LIST OF THOSE WHO HAVE ASSISTED BY READING PROOF, AND IN OTHER WAYS

Allen, R. C., Fruit-grower, Bonita, Calif. (*Olive.*)

Alverson, A. H., Specialist in cacti, San Bernardino, Calif. (*Cacti.*)

Ball, C. D., Wholesale florist, Holmesburg, Philadelphia, Pa. (*Palms and decorative plants.*)

Barker, Charles, Fruit-grower, Milford, Del. (*Peach.*)

Barker, Michael, Editor "American Florist," Chicago, Ill. (*Many suggestions.*)

Bassett & Son, Wm. F., Nurserymen, Hammonton, N. J. (*Native plants, as Hibiscus.*)

Berger & Co., H. H., New York, N. Y. (*Japanese and Californian plants.*)

Betscher C., Florist, nurseryman and seedsman, Canal Dover, Ohio. (*Gladiolus.*)

Blanc, A., Seedsman and plantsman, Philadelphia, Pa. (*Cacti. Canna. Novelties.*)

Boardman, S. L., Sec. Maine Hort. Soc., Augusta, Me. (*Maine.*)

Brackett, Col. **G. B.**, Pomologist, Dept. of Agric., Washington, D.C. (*Hicoria. Hickory. Juglans.*)

Breck & Sons, Joseph, (Corporation), Seedsmen, Boston, Mass. (*Portrait of Joseph Breck.*)

Breese, J. S., Fayetteville, N. C. (*North Carolina.*)

Brotherton, Wilfred, Mich. Wild Flowers, Rochester, Mich. (*Native hardy herbaceous perennials.*)

Brown, O. H., Bordentown, N. J. (*Aquatics.*)

Budlong & Son Co., J. A., Manufacturers of pickles and vinegar, Market-gardeners, Providence, R. I. (*Cucumber. Martynia.*)

Bush & Sons, Bushberg, Mo. (*Grapes.*)

Caldwell, Geo. C., Prof. of Agric. Chemistry, Cornell Univ., Ithaca, N. Y. (*Fertility. Fertilizers. Lime.*)

Clark, Miss **Josephine A.**, Librarian, Dept. of Agric., Washington, D. C. (*Information as to species after the date of Index Kewensis.*)

Clark, J. C., Dreer's nursery, Riverton, N. J. (*Pansy.*)

Clinton, L. A., Asst. Agriculturist, Cornell Exp. Sta., Ithaca, N. Y. (*Lime.*)

Coville, Frederick V., Botanist, Dept. of Agric., Washington, D. C. (*Juniperus. Suggestions in various matters.*)

Cranefield, Frederic, Asst. Horticulturist, Wisconsin Exp. Sta., Madison, Wis. (*Irrigation.*)

Dailledouze Bros., Wholesale florists, Flatbush, Brooklyn, N. Y. (*Mignonette.*)

Dailey, Charles L., Fruit-grower, Salem, Ore. (*Prune.*)

Danby, Charles E., Prune-grower, Salem, Ore. (*Prune.*)

Dandridge, Mrs. Danske, Amateur, Shepherdstown, W. Va. (*Hardy plants.*)

Darlington, E. D., Superintendent of Trials, Fordhook Experimental Farm, Doylestown, Pa. (*Pea.*)

Davenport, Geo. E., Botanist, specialist in ferns, Medford, Mass. (*Several genera of ferns.*)

Day, Miss Mary A., Librarian, Gray Herbarium of Harvard Univ., Cambridge, Mass. (*Rare books.*)

Devron, Dr. G., Amateur in bamboos, New Orleans, La. (*Bamboo.*)

Dock, Miss M. L., Lecturer on plant life, forestry and village improvement, Harrisburg, Pa. (*Bartram.*)

Dosch, H. E., Sec'y State Board of Hort., Hillsdale, Ore. (*Oregon.*)

Downer's Sons, J. S., Fruit-growers, Fairport, Ky. (*Kentucky.*)

Dreer, Henry A. (Inc.), Seedsmen and Plantsmen, Philadelphia, Pa. (*Many and varied services, especially in aquatics, ferns, foliage plants and rare annuals.*)

Elliot, J. Wilkinson, Landscape architect, Pittsburg, Pa. (*Kochia, Oak, and some herbaceous perennials.*)

Ellwanger & Barry, Nurserymen, Rochester, N. Y. (*Hardy plants.*)

Fields, John, Dir. Agr. Exp. Sta., Stillwater, Okla. (*Oklahoma*).

Fisher, Dr. Jabez, Fruit-grower, Fitchburg, Mass. (*Massachusetts.*)

Ganong, W. F., Prof. of Botany, Smith College, Northampton, Mass. (*Cacti, and many suggestions.*)

Gifford, John C., Asst. Prof. of Forestry, College of Forestry, Cornell Univ., Ithaca, N. Y. (*Poinciana.*)

Goodman, L. A., Fruit-grower, Kansas City, Mo. (*Missouri.*)

Halliday, Robt. J., Florists, Baltimore, Md. (*Azalea. Camellia.*)

Harris, J. S., Fruit-grower, La Crescent, Minn. (*Minnesota.*)

Heiges, S. B., York, Pa. (*Pennsylvania.*)

Heiss, J. B., Florist, Dayton, Ohio. (*Palms.*)

Heller, A. A., Botanist, Lancaster, Pa. (*Porto Rico.*)

Hewson, Wm., Orchid grower for Wm. Scott, Buffalo, N. Y. (*Odontoglossum. Oncidium.*)

Hill, Robert T., U. S. Dept. Agric., Washington, D. C. (*Porto Rico.*)

Hosmer, A. W., Botanist, Concord, Mass. (*Polygala.*)

Hutt, H. L., Prof. of Horticulture, Ont. Agric. College, Guelph, Ont. (*Kale. Kohlrabi.*)

Jack, Mrs. Annie L., Chateuguay Basin, Prov. Que. (*Native plants.*)

Jennings, E. B., Specialist in pansies, Southport, Conn. (*Pansy.*)

Jones, Rev. C. J. K., Los Angeles, Calif. (*Various Californian plants.*)

Jordan, Dr. W. H., Dir. N. Y. Exp. Sta., Geneva, N. Y. (*Fertility. Fertilizers.*)

Kedzie, Dr. R. C., Prof. of Chemistry, Mich. Agric. College, Agricultural College, Mich. (*Fertility. Fertilizers. Lime.*)

*King, F. H., Prof. of Agricultural Physics, Univ. of Wisconsin, Madison, Wis. (*Irrigation, Mulching, etc.*)

Latham, A. W., Secretary Minn. Hort. Soc., Minneapolis, Minn. (*Minnesota.*)

Leib, S. F., Prune-grower, San José, Calif. (*Prune.*)

Lindley, J. Van, Nurseryman, Pomona, N. C. (*North Carolina.*)

Lupton, J. M., Market-gardener, Gregory, L. I. (*Cabbage.*)

Lyon, Wm. S., Census Bureau, Washington, D. C. (*Palms.*)

MacDowell, J. A., Nurseryman, City of Mexico, Mex. (*Cacti.*)

Macfarlane, Prof. J. M., Dir. U. of P. Botanic Garden, Philadelphia, Pa. (*Nepenthes. Pinguicula.*)

Mackenzie, R. R., Secretary J. M. Thorburn & Co., New York, N. Y. (*Many important bulbs.*)

Makepeace, A. D., Cranberry-grower, West Barnstable, Mass. (*Cranberry.*)

Manda, W. A., Horticultural expert, South Orange, N. J. (*Orchid pictures.*)

Manning, Jacob W., Nurseryman, Reading, Mass. (*Dried specimens of herbaceous perennial plants.*)

Manning, Robert, Sec. Mass. Hort. Soc., Boston, Mass. (*Biographical sketches. Horticulture.*)

Maxwell Bros., Fruit-growers, Geneva, N. Y. (*Quince.*)

May, John N., Florist, Summit, N. J. (*Florists' Flowers.*)

McDowell, Prof. R. H., Agriculturist and horticulturist, Nev. Exp. Sta., Reno, Nev. (*Nevada.*)

McTear, John, Gardener, Montecito, Calif. (*Some plants cult. in Calif.*)

Meehan, Thos., Nurseryman, Germantown, Pa. (*The article "Horticulture."*)

Meriam, Dr. Horatio C., Salem, Mass. (*Pæonia. Papaver.*)

Miller, E. S., Specialist in bulbs, Floral Park, L. I. (*Many articles on bulbs.*)

Moon, Wm. H., Nurseryman, Morrisville, Pa. (*Pennsylvania.*)

Moorhead, James R., Specialist in Cacti, Cactus Farm, Moorhead, Tex. (*Cacti.*)

Moses, Wallace R., Fruit-grower, West Palm Beach, Fla. (*Orange. Pineapple.*)

Mudge, W. S., Hartland, N. Y. (*Muskmelon.*)

Nanz & Neuner, Florists, seedsmen, and nurserymen, Louisville, Ky. (*Kentucky.*)

Nash, Geo. V., Asst. N. Y. Bot. Garden, Bronx Park, N. Y. (*Genera of grasses.*)

Nickels, Miss Anna B., Specialist in Cacti, Laredo, Tex. (*Certain genera of Cacti.*)

Ohmer, Nicholas, Fruit-grower, Dayton, Ohio. (*Ohio.*)

Parsons, Samuel B., Nurseryman, Flushing, L. I. (*The articles "Horticulture" and "Pomology."*

Pendergast, W. W., Pres. Minn. Hort. Soc., Hutchinson, Minn. (*Minnesota.*)

Pericat, Alphonse, Gardener, West Philadelphia, Pa. (*Læliocattleya.*)

Pierson, F. R., Nurseryman, Tarrytown-on-Hudson, N. Y. (*Bulbs.*)

Ragan, W. H., Div. of Pomology, Dept. of Agric., Washington, D. C. (*Indiana.*)

Rea, Frederic J., Nurseryman, Norwood, Mass. (*Polemonium.*)

Rebmann, Jeremiah, Lincoln, Nebr. (*Philippine Islands.*)

Rider, Prof. A. J., Philadelphia, Pa. (*Cranberry.*)

Robinson, Prof. B. L., Curator Gray Herbarium of Harvard Univ., Cambridge, Mass. (*Various articles on native plants.*)

Robinson, John, Author of "Ferns in their Homes and Ours," Salem, Mass. (*Several articles on ferns.*)

Rock, John, Fruit-grower, Niles, Calif. (*Plum. Prune.*)

Ross, J. J., Fruit-grower, Seaford, Del. (*Peach.*)

Sander & Co. (A. Dimmock, Agent), New York, N. Y. (*Recent importations, particularly orchids and palms.*)

Sandiford, Robert, Specialist in pelargoniums, Mansfield, Ohio. (*Pelargonium.*)

Schultheis, Anton, Florist, College Point, N. Y. (*Woody plants from Australia and the Cape, as Erica.*)

Scoon, C. K., Fruit-grower, Geneva, N. Y. (*Cherry.*)

Scribner, F. Lamson, Agrostologist, Dept. of Agric., Washington, D. C. (*Genera of grasses.*)

Sears, Prof. F. C., School of Horticulture, Wolfville, Nova Scotia. (*Canada.*)

Shady Hill Nursery Co., Boston, Mass. (*Herbaceous perennials.*)

Shaw, Thos., Prof. of Animal Husbandry, Univ. of Minn., Minneapolis, Minn. (*Medicago. Melilotus.*)

Shinn, J. C., Fruit-grower, Niles, Calif. (*Pear.*)

Sievers, John H., Specialist in pelargoniums, San Francisco, Calif. (*Pelargonium.*)

Slaymaker, A. W., Fruit-grower, Camden, Del. (*Delaware.*)

Small, John K., N. Y. Botanical Garden, Bronx Park, N. Y. (*Polygonum.*)

Soltav, Chris., Grower of pansy seed, Jersey City, N. J. (*Pansy.*)

Stanton, Geo., Ginseng specialist, Summit, N. Y. (*Ginseng.*)

Steele, W. C., Horticulturist, Switzerland, Fla. (*Orange, etc.*)

Storrs & Harrison, Nurserymen, Painesville, Ohio. (*Various plants.*)

Sturtevant, Edmund D., Specialist in aquatics, Station E., Los Angeles, Calif. (*Aquatics.*)

Suzuki & Iida, Yokohama Nursery Co., New York, N. Y. (*Japanese plants.*)

Thompson, Mrs. J. S. R., Spartanburg, S. C. (*Perfumery Gardening.*)

Thurlow, T. C., Nurseryman and specialist in pæonies, West Newbury, Mass. (*Pæonia.*)

Todd, Frederick G., Landscape architect, Montreal, P. Q. (*Hardy trees and shrubs.*)

Troth, Henry, Photographer of plants and landscapes, Philadelphia, Pa. (*Photography.*)

Vick's Sons, James, Seedsmen, Rochester, N. Y. (*Various plants.*)

Webb, Prof. Wesley, Dover, Del. (*Delaware.*)

Wedge, Clarence, Fruit-grower, Albert Lea, Minn. (*Minnesota.*)

Whilldin Pottery Co., Philadelphia, Pa. (*Pots.*)

White, J. J., Cranberry-grower, New Lisbon, N. J. (*Cranberry.*)

Willard, S. D., Nurseryman, Geneva, N. Y. (*Important fruits, as Cherry.*)

Wittbold Co., The Geo., Florists, Chicago, Ill. (*Palms and ferns. Nephrolepis Wittboldi.*)

Young, B. M., Specialist in nut culture, Morgan City, La. (*Pecan.*)

ABBREVIATIONS

I. OF GENERAL EXPRESSIONS

cult.	cultivated, etc.
diam.	diameter
E.	east.
ft.	feet.
in.	inches
N.	north.
S.	south.
trop.	tropics, tropical.
W.	west.

II. OF BOTANICAL TERMS

fl.	flower.
fls.	flowers.
fld.	flowered.
fr.	fruit.
h.	height.
lf.	leaf.
lft.	leaflet.
lvs.	leaves.
st.	stem.
sts.	stems.
syn.	synonym.
var.	variety.

III. OF BOOKS AND PERIODICALS

To aid the student in the verification of the work, and to introduce him to the literature of the various subjects, citations are made to the portraits of plants in the leading periodicals to which the American is most likely to have access. These references to pictures have been verified as far as possible, both in the MS. and in the proof. A uniform method of citation is much to be desired, but is extremely difficult, because periodicals rarely agree in methods. With great reluctance it was decided to omit the year in most cases, because of the pressure for space, but the student who lacks access to the original volumes may generally ascertain the year by consulting the bibliographical notes below.

An arbitrary and brief method of citation has been chosen. At the outset it seemed best to indicate whether the cited picture is colored or not. This accounts for the two ways of citing certain publications containing both kinds of pictures, as The Garden, Revue Horticole, and Gartenflora. The figures given below explain the method of citation, and incidentally give some hints as to the number of volumes to date, and of the number of pages or plates in one of the latest volumes.

A few works of the greatest importance are mentioned elsewhere by way of acknowledgment (p. xv). The standard works on the bibliography of botany are Pritzel's Thesaurus and Jackson's Guide to the Literature of Botany; also, Jackson's Catalogue of the Library of the Royal Botanic Gardens, Kew.

A.F.	The American Florist. Chicago. A trade paper founded August 15, 1885. The volumes end with July. Many pictures repeated in "Gng." (14:1524=vol. and page.)
A.G.	American Gardening. New York. Represents 14 extinct horticultural periodicals, including The American Garden (1888–1890). Founded 1879(!) (20:896=vol. and page.)
B.	The Botanist. Edited by Maund. No years on title pages. Founded 1839. 8 vols., 50 colored plates in each vol. (8:400=vol. and col. plate.) Cumulative index.
B.B.	Britton & Brown. An Illustrated Flora of the Northern U. S., etc. New York. 1896–1898. (3:588=vol. and page.)
B.F.	See F.
B.H.	La Belgique Horticole. Ghent. 35 vols. (1851–1885.)
B.M.	Curtis' Botanical Magazine. London. Founded 1787. The oldest current periodical devoted to garden plants. The vol. for 1899 is vol. 125 of the whole work. Index to first 107 volumes by E. Tonks. London. (7690=col. plate.)
B.R.	Botanical Register (1815–1847). Vols. 1–14 edited by Edwards: vols. 15–33 by Lindley. In vols. 1–23 the plates are numbered from 1–2014. In vols. 24–33 they are numbered independently in each vol. There are 688 plates in vols. 24–33. "An Appendix to the First Twenty-three Volumes" (bound separately or with the 25th vol.) contains an index to the first 23 vols. An index to vols. 24–31 may be found in vol. 31. (33:70=vol. and col. plate.)
D.	Dana. How to Know the Wild Flowers. New York. 1893. (298=page.)
Em.	Emerson, G. B. Trees and Shrubs of Massachusetts. Boston. 2 vols. 149 plates.
F.	The Florist. London. 1840–1884. (1884:192=year and page pp. col. plate.) Editors and title pages changed many times. Known as the Florist, Florist's Journal and Florist and Pomologist. Sometimes improperly called British Florist.
F.C.	Floral Cabinet. Knowles & Westcott. London. 1837–1840. (3:137 vol. and col. plate).

F.E.	The Florists' Exchange. New York. A trade paper, whose pictures sometimes are repeated in "A.G." Founded Dec. 8, 1888. (11:1298=vol. and page.)
F.J.	See F.
F.M.	Floral Magazine. London. Series I. 1861–1871, 8vo. Series II. 1872–1881, 4to. (1881:450=year and col. plate.)
F.P.	See F.
F.R.	Florists' Review. Chicago. A trade paper. Vol. 1, Dec. 2, 1897, to May 26, 1898. Two vols. a year. (4:660=vol. and page.)
F. S.	Flore des Serres. Ghent. (1845–1880.) Inconsistent in numbering, but the plate numbers are always found on the plate itself or on the page opposite. Valuable but perplexing indexes in vols. 15 and 19. (23:2481=vol. and col. plate.)
G. C.	The Gardeners' Chronicle. London. Series I. (1841–1873) is cited by year and page. Series II. or "New Series" (1874–1886), is cited thus: II. 26:824=series, volume and page. Series III. is cited thus: III. 26:416. Two vols. a year, beginning 1874. A select index is scattered through 1879 and 1880. Consult II. 12:viii (1879), and similar places in subsequent vols.
G. F.	Garden and Forest. New York. 1888–1897. (10:518=vol. and page.)
G.M.	Gardeners' Magazine. London. Ed. by Shirley Hibberd. Founded 1860. Vols. 31–42 are cited. (42:872=vol. and page.)
Gn.	The Garden. London. Founded 1871. Two vols. a year. (56:1254=vol. and col. plate. 56, p. 458=vol. and page containing black figure.) An Index of the first 20 vols. was separately published. Complete Index of Colored Plates to end of 1897 in vol. 54, p. 334.
Gng.	Gardening. Chicago. Founded Sept. 15, 1892. Vols. end Sept. 1. (7:384=vol. and page.)
Gt.	Gartenflora. Berlin. Founded 1852. (Gt. 48:1470=vol. and col. plate. Gt. 48, p. 670=vol. and page containing black figure.)
G.W.F.	Goodale's Wild Flowers of America. Boston, 1886. (50=col. plate.)
HBK.	Humboldt, Bonpland & Kunth. Nova Genera et Species, etc. Paris. 1815–25. 7 vols. Folio.
I. H.	L'Illustration Horticole. Ghent. (1854–1896.) (43:72=vol. and col. plate.) The volumes were numbered continuously, but there were 6 series. Series I.=1854–63. Series II.=1864–69. Series III.=1870–80. Series IV. = 1881–86. Series V. = 1887–93. Series VI. =1894–96. The plates were numbered continuously in the first 16 vols. from 1 to 614: in vols. 17–33 they run from 1 to 619: in series V. from 1 to 190: in Series VI. they begin anew with each vol. Valuable indexes in vols. 10 and 20. Series V. in 4to, the rest 8vo.
J.H.	Journal of Horticulture. London. Founded in 1848 as The Cottage Gardener. Series III. only is cited, beginning 1880. (III. 39:504=series, vol., page.)
K.W.	See F. C.
L.	In vol. 1 of this work, sometimes means Lindenia, sometimes Lowe's Beautiful Leaved Plants. See "Lind." and "Lowe."
L.B.C.	The Botanical Cabinet. Loddiges. 1817–33. 100 plates in each vol. Complete index in last vol. (20:2000=vol. and col. plate.)
Lind.	Lindenia, Ghent. Founded 1885. Folio. Devoted to orchids.
Lowe	Beautiful Leaved Plants. E. J. Lowe and Howard. London. 1864. (60=col. plate.)
M.	A. B. Freeman-Mitford. The Bamboo Garden. London. 1896. (224=page.)
M.D.G.	Möller's Deutsche Gärtner-Zeitung. Erfurt. Founded 1886. (1897:425=year and page.)
Mn.	Meehan's Monthly. Germantown, Philadelphia. Founded 1891. (9:192 = vol. and page opposite col. plate.)
N.	Nicholson. Dictionary of Gardening. Vols. 1–4 (1884–1887). Vol. 5 in preparation.
P.F.G.	Lindley & Paxton. Flower Garden. London. 1851–53. 3 vols. 4to.
P.G.	Popular Gardening. Buffalo. 1885–90. (5:270=vol. and page.)
P.M.	Paxton's Magazine of Botany. London. 1834–49. (16:376 = vol. and page opposite col. plate.) Vol. 15 has index of first 15 vols.
R.	Reichenbachia. Ed. by Fred. Sander. London. Founded 1886. Folio.
R.B.	Revue de l'Horticulture Belge et Etrangère Ghent. Founded 1875? (23:288=vol. and page opposite col. plate.) In the first vol. of the Cyclopedia "R.B." sometimes means Belgique Horticole, but the confusion is corrected in later vols., where Belgique Horticole is abbreviated to "B.H."
R.H.	Revue Horticole. Dates from 1826, but is now considered to have been founded in 1829. (1899:596=year and page opposite col. plate. 1899, p. 596=year and page opposite black figure.)
S.	Schneider. The Book of Choice Ferns. London. In 3 vols. Vol. 1, 1892. Vol. 2, 1893.
S.B.F.G.	Sweet British Flower Garden. London. Series I., 1823–29, 3 vols. Series II., 1831–38, 4 vols.
S.H.	Semaine Horticole. Ghent. Founded 1897. (3:548=year and page.)
S.M.	Semaine Horticole. Erroneously cited in this fashion a few times in first vol.
S.S.	Sargent. The Silva of North America. 13 vols. Vol. 1, 1891. Vol. 12, 1898. (12:620=vol. and plate, not colored.)
S.Z.	Siebold & Zuccarini. Flora Japonica. Vol. 1, 1835–44. Vol. 2 by Miquel, 1870. (2:150=vol. and plate.)
V. or V. M.	Vick's Magazine. Rochester, N. Y. Founded 1878. Vols. numbered continuously through the 3 series. Vols. begin with Nov. (23:250=vol. and page.) Sometimes cited as "Vick."

⁂ *Additional abbreviations and explanations will be found in the introductory pages of Vol. I.*

Cyclopedia of American Horticulture

NÁBALUS. See *Prenanthes.*

NÆGÈLIA (Karl von Nægeli, late professor of botany at Munich). *Gesneràceæ.* About half a dozen tropical American herbs allied to Achimenes, but the fls. arranged alternately in a leafless terminal panicle (in Achimenes the fls. are axillary). Because of the panicled flowers, Nægelias are very ornamental plants. They are warmhouse subjects, propagating by stolons or offsets. In cultivation the plants are oftener called Gesnerias than Nægelias, but they are distinguished from that genus in usually having an annular or ring-like disk at the base of the corolla, rather than a deeply lobed disk. Tubers usually none. Nægelias hybridize with other Gesnerias. One hybrid race is known as Nægelio-Achimenes and another (F.S. 10:987–8) as Mandirola.
L. H. B.

In general, the cultural methods given under *Gesneria* suit Nægelias well. The bulbs should be stored in the pots in which they have been grown. It is a bad plan to keep any bulbs or tubers of the Gesneriaceæ in dry sand in a dry store-room. After being well ripened, Nægelia bulbs should be kept in the greenhouse under the benches. Keep them out of the drip, but water them occasionally.
T. D. Hatfield.

A. *Fls. nearly scarlet, or brick-red, marked with white.*

cinnabarìna, Lind. (*Gesnèria cinnabarìna,* Lind.). Fine winter-blooming plant, 1½–2 ft. tall, soft-hairy: lvs. round-ovate and cordate, crenate-dentate, thickish, green, with red or purplish hairs: fls. about 1½ in. long, hanging on the ends of spreading pedicels, gibbous-tubular to the very base, the calyx-lobes acute and spreading, the short corolla-lobes unequal and obtuse, the flower cinnabar-red or nearly scarlet on the upper side, but paler and spotted on the under side. Mex. B.M. 5036. Lowe, 33.

AA. *Fls. orange-scarlet or scarlet, marked with yellow.*

zebrìna, Regel (*Gesnèria zebrìna,* Paxt.). Fig. 1454. Much like the above, but brighter colored, red-dotted below, and yellow within and on the under side: calyx-lobes short and appressed: corolla contracted towards the base, whereas they are gibbous or swollen to the very base in *N. cinnabarina.* Brazil. B.M. 3940. B.R. 28:16. P.M. 271.—A fine plant, of which there are several forms. The commonest species. Names belonging here are *Gesneria regalis* and *G. splendens.*

achimenoides, Hort. Hybrid of *N. zebrina* and Achimenes or Gloxinia (said to be with *A. gloxiniæflora*): fls. very large (often 2 in. long), yellowish rose on the outside, yellow and rose-spotted on the inside, the segments clear rose.

AAA. *Fls. white, cream color or rose.*

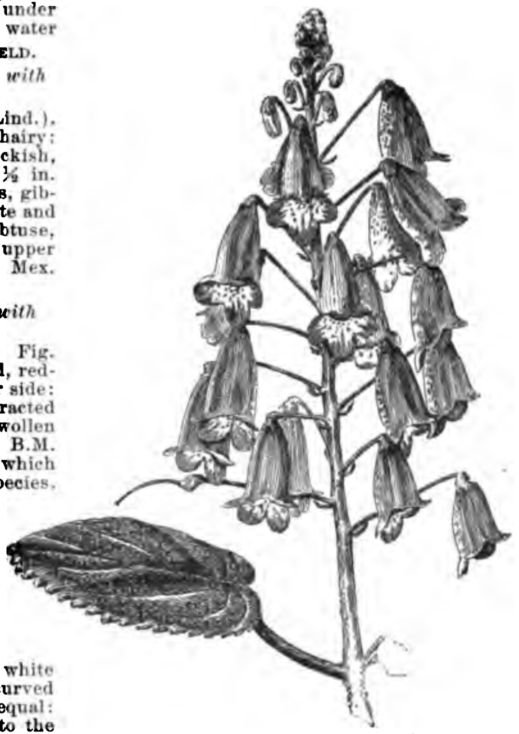
amábilis, Decne. (*N. multiflòra,* Hook.). Fls. white or cream color, numerous, hanging, the tube curved and not much swollen, the obtuse lobes subequal: plant bearing long, glandular hairs in addition to the velvety covering: otherwise much like *N. zebrina.* Mex. B.M. 5083. F.S. 12:1192 (as *Achimenes* [*Nægelia*] *amabilis*). G.C. III. 22:413.—The tenable name of this species is usually held to be Hooker's *N. multiflora,* which dates from 1858; but Decaisne's *N. amabilis,* or *N. amabilis,* Hort., is older.

hyacinthìna, Carr. Of horticultural origin, probably a hybrid: fls. white or rose, in a very compact pyramidal panicle. R.H. 1877:29.

N. fúlgida, Ort. Fls. vermilion: lvs. large, oval, deeply toothed. Mex.—*N. Geroltiàna,* Regel. Continuous-flowering plant, allied to N. zebrina. Mex. F.S. 2:pl. 4, for April.—*N. sceptre corail,* Carr. Fls. many in an open panicle, cinnabar-red, yellow-spotted inside. R.H. 1869, p. 154 and col. plate. For pictures of varieties and hybrids, see F.S. 16:1671–2; 10, 987–8.
L. H. B.

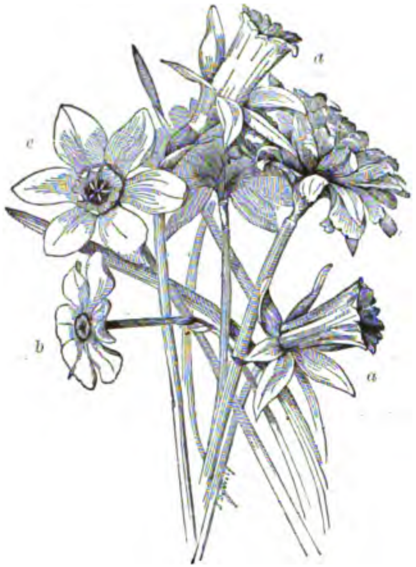
NÆGELIO-ACHIMENES is a trade name mentioned under *Nægelia.*

NANDÌNA (Japanese name). *Berberidàceæ.* A small, tender shrub, with bright red or white berries, said to be cult. in every little garden in Japan. "At a distance, says Kæmpfer, it has a reed-like appearance, many simple stems springing up from the same root, which are branched toward the top only, and are terminated with a pyramidal panicle of red berries the size of a pea."—B.M. The stems are about as thick as a finger. The foliage is evergreen, and graceful at all times, being twice or thrice ternately cut. The young growth is prettily tinged with red, and the bases of the lower stalks are often swollen into red globular bodies. The fls. are small, numerous, white and panicled. This shrub is rarely grown North under glass. Pot-grown plants or seeds are procurable from Japanese dealers. The seeds are said to be of an uncommon shape, being convex on one side and concave on the other.



1454. Naegelia zebrina.
Generally known as a Gesneria.

The genus contains but one species. It is the only erect-growing shrub in the barberry family outside of Berberis. It agrees with the common barberries in having 6 stamens and an indehiscent berry, but the fls. are differently



1455. Narcissi.
a a, N. Pseudo-Narcissus; *b*, N. Jonquilla; *c*, N. poeticus.

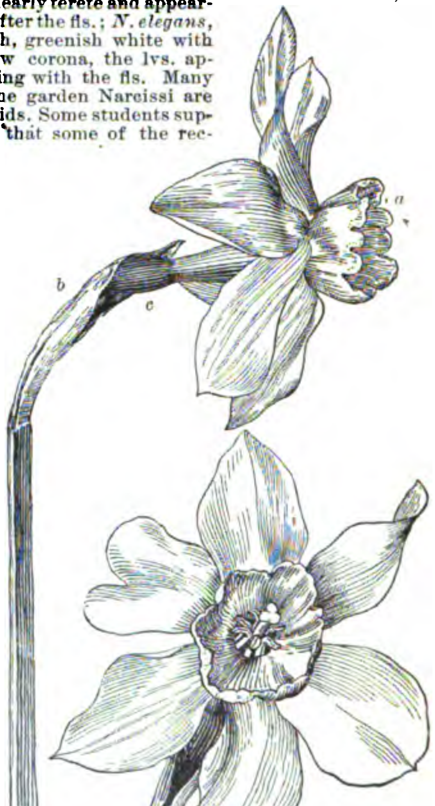
colored and the sepals more numerous. There are about 6 petals, but the numerous sepals gradually pass into petals, the outer ones being small, green and leathery, the inner larger and whiter. Ovules 2, ascending from the base.

doméstica, Thunb. Described above. Lfts. entire. Japan and China. B.M. 1109. Gn. 23, p. 329; 58, p. 13.
W. M.

Nandina domestica is an old favorite in S. Calif., and many fair-sized specimens may be seen, though 8 ft. high is the largest the writer can call to mind now. Of late years the sale of Nandina has been very slight, as it is not very desirable, except for its general effect as a shrub, and it takes some years to make a show. Many faster growers and better bloomers have taken its place. It does not produce sufficient foliage; the stem is always bare, leaving an indistinct whorl of lvs. at the extreme top. The fls. are inconspicuous. It is of easy culture, and does best in a position shaded from the sun during the hotter part of the day. It stools very freely, and for this reason is somewhat used in shrubberies, where its otherwise naked stems would render it valueless. ERNEST BRAUNTON.

NAPOLEÒNA (after Napoleon Bonaparte). *Myrtàceæ*. *Napoleona imperialis* is a truly imperial plant, and worthy of being named after the distinguished military leader. It is a tropical African tree, with flowers that at once suggest a royal crown. They look something like a gorgeous passion flower, with equally rich though different coloring, and the same simplicity and symmetry of design expressed in the same rich multiplicity of detail. They are shaped like a saucer, about 2 inches in diameter, and the dominant color is apricot. Inside the saucer are two crowns, one within the other, the inner one smaller. The rim of the saucer is broken up into about 35 blunt teeth, all regular and formal, each one with a plait running down the back to the center of the saucer, and each tooth minutely serrate around its margin. In the bottom of the saucer is a circular fringe of green threads, all of equal length and fineness, springing from the base of the larger crown. This fringe is displayed against a rich, dark red background, which imitates in outline the toothed rim of the saucer, and colors perhaps three-fourths of the bottom of the saucer. In the Flora of Tropical Africa the fls. are said to be red, white or blue. Elsewhere it is stated that the fls. turn bluish as they decay. This interesting tree seems never to have been offered in America, but is probably procurable from Europe. B.M. 4387. G.C. 1844:780. R.H. 1853, p. 301.

NARCÍSSUS (old name, thought by some to be derived from the story of the youth Narcissus, and by others from the Greek word for narcotic, in allusion to the narcotic-poisonous properties of the plant). *Amaryllidàceæ*. Plate XX. Figs. 1455–1462. Narcissi are amongst the choicest of hardy spring-flowering plants. They have long been favorites. In recent years some of the species have come into prominence as subjects for winter forcing. Baker, in his Handbook of the Amaryllideæ, 1888, reduces the species to 16, but garden authors usually recognize thrice that many. They are mostly native to southwestern Europe and the Mediterranean region. The peculiar characteristic of the Narcissi is the conspicuous crown or short tube in the throat of the corolla, with which the stamens are not united. The flowers (Fig. 1456) have 6 spreading segments, 3 of which are exterior; stamens 6, attached to the corolla-tube; fls. single or several from a dry spathe, usually standing at an angle on the pedicels: bulbs tunicated, the outer scales dark-colored: fr. a thin dehiscing capsule, containing nearly globular or angular seeds: lvs. linear or even awl-like, appearing with the flowers. Narcissi are spring-blooming bulbs, most of them perfectly hardy in the northern states and capable of being naturalized in cool and grassy places. Some of the species are popular bulbs for winter forcing. The genus includes the Daffodils (Daffy-down-dillies) and Jonquils. There are autumn-flowering species, but they are little known to cultivators. These autumn bloomers are of 3 species: *N. viridiflorus*, Schousb., fls. green throughout, lvs. nearly terete and usually not appearing with the fls.; *N. serotinus*, Linn., pure white with yellow corona, the lvs. nearly terete and appearing after the fls.; *N. elegans*, Spach, greenish white with yellow corona, the lvs. appearing with the fls. Many of the garden Narcissi are hybrids. Some students suppose that some of the rec-



1456. Narcissus incomparabilis.
Corona shorter than usual. *a* shows the corona; *c*, the ovary; *b*, the spathe. Natural size.

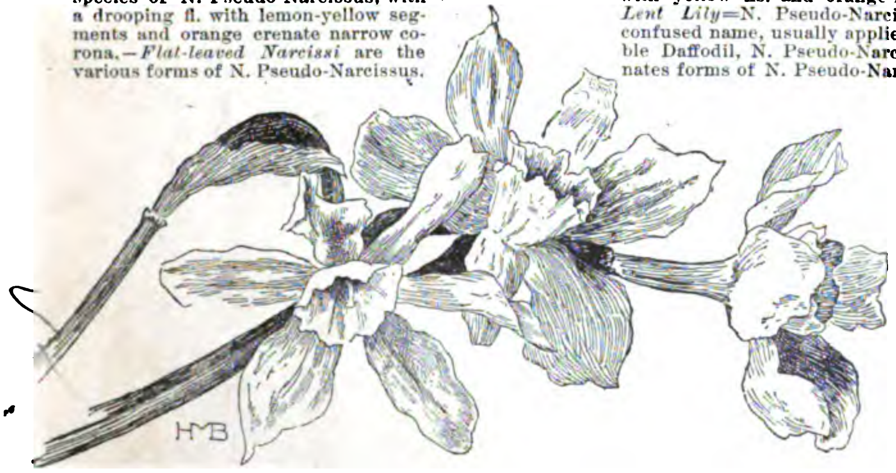
ognized species (as *N. incomparabilis* and *N. odorus*) are hybrids. See Engleheart, Journ. Roy. Hort. Soc. 17, p. 35.

The word Daffodil is variously used. In this country it means usually the full double forms of *N. Pseudo-Narcissus*, plants which ~~are very~~ common in old gardens. Modern named varieties of this Daffodil type are Van Sion and Rip Van Winkle. In England, however, Daffodil is a more general term, used for most species except the Poet's Narcissus (*N. poeticus*).

There are numberless forms of garden Narcissi. Some of these are hybrids and others are direct variations from the pure or original species. Many of these forms bear Latin names, as if they were species, and thereby confusion often arises. The most serviceable classification is based on the size and shape of the crown or corona. Baker recognizes three great sections, which are followed below. The standard works on the Narcissus in English are Burbidge's "The Narcissus," with many colored plates, and Peter Barr's "Ye Narcissus or Daffodyl Flowre, and hys Roots." Haworth wrote a Monograph of Narcissi in 1831, in which he made 16 genera of the plants which are now referred to Narcissus. For 300 years and more, some of the species have been known as cultivated plants. In the following account, the main or stem species are given; and the most common trade and class names are given in an introductory paragraph, with notes as to their botanical positions.

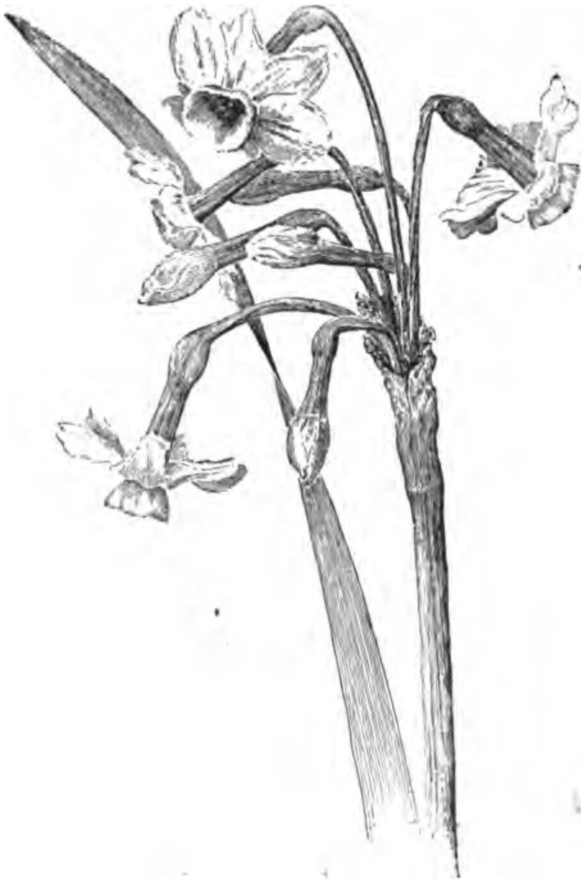
Following are the common and important Latin-form trade names (see the main list, below): ***Albicans***, a form of N. Pseudo-Narcissus, var. moschatus, the segments white and the corona primrose, changing to white.—***Ajax*** is an old generic name for N. Pseudo-Narcissus; this species is now sometimes called the Ajax Narcissus.—***Backhousei*** (Pseudo-Narcissus × incomparabilis) has single horizontal yellow flowers with tube nearly equaling the segments.—***Barrii*** (poeticus × Pseudo-Narcissus or incomparabilis × poeticus), of the medium-crowned section, has yellow horizontal fls. with long, slender neck; "covers a series of forms intermediate between incomparabilis and poeticus, nearer the former than the latter" (Baker); Fig. 1457.—***Bernardi*** is like N. Macleaii, but with a more plicate and deeper-colored corona.—***Bunch-flowered Daffodils*** are N. Tazetta.—***Burbidgei*** (probably incomparabilis × poeticus, in a series of forms) has the habit of N. poeticus, with a solitary drooping flower with white segments and a very short corona with a yellow base and red rim.—***Cambricus*** is an early whitish bicolor.—***Capax plenus*** is an old name for a double form, now undeterminable.—***Cernuus***, form of N. Pseudo-Narcissus, var. moschatus, with a drooping, silvery white fl.; early.—***Corbularia Narcissi*** are the N. Bulbocodium forms. Corbularia is an old generic name for this species.—***Cyclamineus*** (B.M. 6950) is a subspecies of N. Pseudo-Narcissus, with a drooping fl. with lemon-yellow segments and orange crenate narrow corona.—***Flat-leaved Narcissi*** are the various forms of N. Pseudo-Narcissus.—***Ganymedes*** is an old generic name for N. triandrus and its forms.—***Giganteus*** = Sir Watkin.—***Graellsii*** is a form of N. Bulbocodium with small cream-white fls. B.M. 6473 B.—***Grandiflorus*** is applied to a large-fld. white form of N. Tazetta.—***Humei*** (incomparabilis × Pseudo-Narcissus) has a single nodding yellow flower with long, straight cup (often equaling the segments, but variable in size).—***Leedsii*** (probably poculiformis × incomparabilis) has slender-tubed horizontal or drooping fls. with white segments and yellow to whitish corona; one of the medium-crowned kinds; Baker mentions a var. Leedsii of N. incomparabilis with yellow fls. and orange-red rim to the corona.—***Lent Lily***=N. Pseudo-Narcissus.—***Lobularius*** is a confused name, usually applied to the deep yellow double Daffodil, N. Pseudo-Narcissus.—***Lorifolius*** designates forms of N. Pseudo-Narcissus.—***Lusitanicus*** is a name for a bicolor N. Pseudo-Narcissus.—***Macleaii*** (probably Pseudo-Narcissus × Tazetta) is a 1- to 2-fld. plant of stout growth, bearing horizontal short-tubed fls. with white segments and yellow crenate corona half or more the length of the lobes. B.M. 2588. B.R. 12:987.—***Major*** (N. major, Curt; B.M. 51) is a form of N. Pseudo-Narcissus, very robust, with deep golden yellow flower.—***Mastersianus*** is a hybrid of N. Tazetta and N. poculiformis.—***Maximus*** is a large-fld. form of N Pseudo-Narcissus with

1458. Single Trumpet Daffodil—N. Pseudo-Narcissus. (× ½.)



1457. Narcissus Barrii. One of the popular hybrids.

yellow fls.—*Milneri*, hybrid of N. incomparabilis and N. Pseudo-Narcissus, var. moschatus.—*Minor* (N. minor, Linn.) is a very dwarf form of N. Pseudo-Narcissus (6 in. or less high), with sulfur-yellow segments and deeper yellow corona.—*Montanus* = poculiformis. — *Muticus* (Ajax muticus, Gay) is a form of N. Pseudo-Narcissus with narrow yellow corona and sulfur-yellow segments. —*Nelsoni*, a subtype of N. Macleaii, very robust, and fls. larger (2–3 in. across), the corona more than half as long as the segments.—*Obvallaris* is a dwarf form of N. Pseudo-Narcissus, with floriferous habit, bright yellow fls. and rather short segments.—*Ornatus* is an early form of N. poeticus.—*Pallidus*, a white form of N. Pseudo-Narcissus.—*Peerless Narcissi* are the forms of N. incomparabilis. — *Poculiformis* (or N. montanus, Ker; B.R. 2:123) has 1 or 2 nodding white fls. and a straight corona about half the length of the segments; origin doubtful: by some regarded as a hybrid and by others as a native of the Pyrenees. *Princeps*, sulfur-yellow and yellow-crowned, a form of the N. Pseudo-Narcissus type.—*Queltia* is an old generic name to distinguish the group comprising N. incomparabilis.—*Rip Van Winkle* is a double variety of N. Pseudo-Narcissus.—*Roman Narcissus* is a name for double-fld. N. Tazetta, white with orange cup.—*Rugilobus*, large-fld. pale yellow variety of N. Pseudo-Narcissus.—*Scoticus*, N. Pseudo-Narcissus with deep yellow corona and whitish segments; known as Scotch Garland Lily.—*Sir Watkin* or *giganteus* is a very large-fld. form of N. incomparabilis.—*Spurius*, a yellow N. Pseudo-Narcissus, a subform of var. major.—*Telamonius*, a yellow N. Pseudo-Narcissus, usually known as Van Sion.—*Telamonius plenus* is a double form.—*Tenuior* is a slender form of N. gracilis, the small pale fls. changing to white. B.M. 379.—*Tortuosus* has twisted segments: a form of N. Pseudo-Narcissus, var. moschatus.—*Tridymus* is like N. Nelsoni, but has 2–3 fls., with tube usually obconic.—*Van Sion* is a large pure yellow and very double form of N. Pseudo-Narcissus, much used for forcing. There is also a single Van Sion. —*Variiformis* is a form of N. Pseudo-Narcissus with canary-yellow corona and white segments, the fls. variable.



1459. Paper White Narcissus—N. Tazetta, var. alba (× ⅔).

INDEX TO NAMES IN THE MAIN LIST.

albæ, 7b.
albus, 4, 11.
aurantis, 4.
aureus, 7c.
Bertolonii, 7c.
bicolor, 2, 7a.
biflorus, 11.
breviflos, 2.
Bulbocodium, 1.
calathinus, 3.
Canariensis, 7b.
Chinese Sacred Lily, 7a.
citrinus, 1.
Clusii, 1.
Corcyrensis, 7a.
cupularis, 7c.
Cyclamen-flowered Narcissus, 3.
Daffodils, 1, 2.
dubius, 7b.
gracilis, 9.
Hoop-Petticoat Daffodil, 1.
Horsfieldii, 2.
incomparabilis, 4.
intermedius, 8.
Italicus, 7c.
Jonquil, 10.
Jonquilla, 10.
juncifolius, 6.
lacticolor, 7a.
Lent Lily, 2.
luteæ, 7c.
monophyllus, 1.
moschatus, 2.
ochroleucus, 7a.
odorus, 5.
orientalis, 7a.
pachybolbos, 7b.
Panizzianus, 7b.
Paper White, 7b.
papyraceus, 7b.
patulus, 7a.
Pheasant's Eye, 12.
poeticus, 12.
polyanthus, 7b.
Polyanthus Narcissus, 7.
Primrose Peerless, 11.
Pseudo-Narcissus, 2.
radiiflorus, 12.
Tazetta, 7.
triandrus, 3.
Trumpet Daffodil, 2.

A. MAGNICORONATI *or* LARGE-CROWNED *species: corona as long as the segments, or even longer, trumpet-shaped or cylindrical.*—DAFFODILS. (Forms of No. 3 may be sought here.)

B. *Lvs. green, few (often only 1), very slender and nearly terete, channelled.*

1. **Bulbocòdium**, Linn. HOOP-PETTICOAT DAFFODIL. A slender plant, with bulb 1 in. or less in diam., and the very slender lvs. (usually 3 or 4 to each stem) mostly overtopping the blossoms: fl. 1, ascending or horizontal (not declined), 1½ or 1¾ in. long in most forms, normally bright yellow in all parts, the very prominent thin corona entire or crenulate; stamens inserted near the base of the tube, declined, rather long. S. France to Morocco. B.M. 88.—Runs into many garden forms and hybrids. Fls. usually borne 5–8 in. above the ground.

Var. **monophỳllus**, Baker (*N. monophỳllus*, Moore. *N. Clùsii*, Dunal). An Algerian form, now in cult., usually with 1 lf., and fl. sessile and white: corona crenate. B.M. 5831.

Var. **citrinus**. Baker. Fls. large, pale lemon-yellow, the corona crenulate.

BB. *Lvs. glaucous, several, flat.*

2. **Pseùdo-Narcíssus**, Linn. COMMON DAFFODIL. TRUMPET DAFFODIL. LENT LILY. Fig. 1458. Strong plant, 12–18 in. tall, with bulb 1½–2 in. in diam.: lvs. narrow but flat, erect, usually about reaching the blossoms: fl. about 2 in. long, horizontal or ascending, pale yellow, the segments and corona usually of different shades, the corona deeply crenate or almost crenate-fimbriate, more or less plicate; stamens inserted near the base of the perianth, short. From Sweden and England to Spain and Austria.—Exceedingly variable in size, shape and coloring of fls. There are full double forms (Common Daffodil) in which the corona disappears as a separate body, and supernumerary segments are present. It is one of the hardiest and commonest of Narcissi.

This species is the Trumpet Narcissus, so named from the long corona. The normal forms are Yellow Trumpets, but the Bicolor Trumpet, var. **bìcolor**, Hort. (*N. bìcolor*, Linn.), has pure white segments and yellow corona. To this variety Baker refers *N. brèviflos*, Haw. (B.M. 1187), and *N. Hórsfieldii*, Burb. The White Trumpets are var. **moschàtus**, Hort. (*N. moschàtus*, Linn.; B.M. 1300), which has cream-white or white flowers.

AA. MEDIOCORONATI *or* MEDIUM-CROWNED *species: corona usually about half the length of the segments, cup-shaped.* (Forms of N. triandrus may have large crowns.)

B. *Segments narrow, standing straight backwards (reflexed).*

3. **triándrus,** Linn. CYCLAMEN-FLOWERED NARCISSUS. Slender (scape 10–18 in. tall), bulb ¾ in. or less in diam., the lvs. few, very slender and semi-cylindrical and not overtopping the blossoms: fls. 1–several, horizontal or drooping, an inch long, both the lanceolate segments and the entire cup-shaped corona pure white in the type; stamens sometimes a little exserted. Spain and Portugal.

1460. The Jonquil—Narcissus Jonquilla (× ½).

Var. **calathinus** (*N. calathinus*, Red., Burbidge, etc., not Ker-Gawl). Corona larger, nearly or quite as long as the segments, the flower pale yellow. Island of Brittany.

BB. *Segments oblong or broader, spreading.*

C. *Lvs. flat (but narrow) and glaucous.*

4. **incomparábilis,** Mill. Figs. 1456. Strong fine species, with large bulb (1½ in. in diam.) and 3–5 lvs., which are nearly or quite the length (1 ft. long) of the distinctly 2-edged scape: fl. always one, not fragrant, horizontal or somewhat ascending, on a very short pedicel, the tube usually greenish, the segments and cernate-plicate corona pale yellow in the type (but varying to other color combinations), the stamens not exserted. S. France and Spain to the Tyrol. B.M. 121.—One of the commonest species in cult., the fls. often 3–4 in. across. Double forms are frequent. Var. **álbus,** Hort., has white fls., with the corona usually pale yellowish. Var. **aurántis,** Hort., has the corona orange at the top.

C. *Lvs. linear and channelled, green.*

5. **odòrus,** Linn. Lvs. half the width (¼ in.) of those of *N. incomparabilis*, the bulb nearly or quite as large, the peduncle terete or very nearly so: fls. about 2 (sometimes 4), fragrant, the tube more slender than in *N. incomparabilis*, and the corona somewhat smaller, the fl. bright yellow throughout. France and Spain and eastward. B.M. 934 (as *N. calathinus*).—A good hardy species, differing from *N. incomparabilis* chiefly in its narrow leaves, 2 or more blossoms to a peduncle, fls. fragrant.

6. **juncifòlius,** Lag. Small, slender species, with bulb about ½ in. in diam., and very narrow, rush-like lvs., about 6 in. long and about equaling the terete scape: fls. 1–4, horizontal or ascending, the tube slender-cylindrical (½ in. long), the broad-ovate, spreading segments and the cup-shaped, crenulate corona bright yellow. S. France and south.—A choice fancier's plant.

AAA. PARVICORONATI *or* SMALL-CROWNED *species: corona usually much less than half the length of the segments, mostly saucer-shaped.*

B. *Corona soft and uniform in texture: lvs. various.*

C. *Lvs. ½ in. or more broad, flat, somewhat glaucous.*

7. **Tazétta,** Linn. POLYANTHUS NARCISSUS. Fig. 1459. Strong species, the bulb often 2 in. in diam., the lvs. 1½ ft. or less long, about the length of the flattened peduncle: fls. several (4–12), horizontal or declined on slender pedicels, the tube less than 1 in. long and greenish, the spreading, broad segments pure white, and entire corona lemon-yellow, the whole fl. about 1½ in. across. Canary Isl. to China and Japan.—The commonest species and the most variable. "Of the multiform Tazetta Narcissi about 100 have received specific names."—*Baker*. "The numerous forms of *N. Tazetta* are so extremely variable that nothing short of fifty folio plates would do the plant justice."—*Burbidge*. All this mass of varieties is readily grouped under one specific type, however, which is recognizable by the many small-crowned fls. and the broad lvs. The variations are largely in color and in size of fls. Baker makes three groups:

a. *bicolores*, the perianth white and the corona yellow. Here are to be placed *lacticolor*, *Corcyrensis*, *patulus*, *ochroleucus* and many others. It is probable that the "Chinese Sacred Lily" (*N. orientalis*, Linn. B.M. 948) is a form of this subtype, although Baker suggests that it is *N. incomparabilis* × *Tazetta*. It is known as Tazetta, var. **orientàlis,** Hort.

b. *albæ*, entire fl. white. Here belongs the "Paper White," very popular for winter bloom. Here are to be referred the names *papyraceus*, *Panizzianus*, *dubius*, *Canariensis*, *pachybolbos*, *polyanthos*.

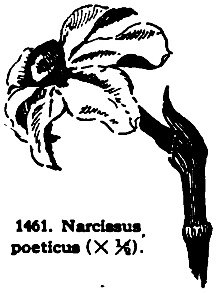
c. *luteæ*, entire fl. yellow. Here belong *aureus*, *cupularis*, *Bertolonii*, *Italicus*.

CC. *Lvs. ¼ in. or less broad, mostly terete or subterete, not glaucous.*

8. **intermèdius,** Lois. A yellow-fld. species, distinguished from *N. Tazetta* chiefly by its subterete, deep-channeled green lvs., which are only ¼ in. wide: peduncle nearly terete. S. France and Spain.

9. **grácilis,** Sabine. Smaller, 1 ft. high, the peduncle 2-edged, the bright green lvs. ⅛ in. or less wide and very convex on the back: fl. pale yellow, the corona usually somewhat deeper colored than the segments. S. France (?). Known chiefly as an old garden plant. B.R. 10: 816.

10. **Jonquílla,** Linn. JONQUIL. Fig. 1460. Very slender and graceful plant, 1½ ft. or less tall, the lvs. and peduncle about equal in height, the lvs. glossy dark green and very narrow and rush-like: fls. 2–6, fragrant, the slender cylindrical tube greenish yellow and an inch or less long, the segments yellow, obovate and scarcely overlapping, the corona very short (⅛ in. or less long), crenate, the same color as the segments. S. Eu. and Algeria. B.M. 15.—One of the old-fashioned fls., perfectly hardy in N. Y



1461. Narcissus poeticus (× ½).

BB. *Corona with a prominently hardened or dry rim: lvs. broad.*

11. **biflòrus,** Curt. PRIMROSE PEERLESS. Strong species, with bulb 2 in. or less in diam.: lvs. 1–2 ft. long and nearly or quite ½ in. broad, and slightly glaucous, usually equaling and sometimes exceeding the

stout 2-edged peduncle: fls. 1–3, usually 2, white, with a pale yellow cup, the tube greenish white and 1 in. long, the segments broad-obovate and overlapping, the corona ⅛ in. long, with a crisped edge. Var. **álbus** has white fls. S. Eu. B.M. 197.—This plant has a wide range in the wild state, but some persons regard it as a hybrid of *N. Tazetta* and *N. poeticus*. Apparently little known in this country.

12. **poéticus**, Linn. PHEASANT'S EYE. Figs. 1461, 1462. Strong-growing species, sometimes 1½ ft. high, the bulb about 1 in. thick, the lvs. equaling or exceeding the 2-edged peduncle and ½ in. broad, somewhat glaucous: fl. solitary (rarely 2), fragrant, wide open, the obovate overlapping segments white, the very short, yellowish corona much crisped and red-edged. Mediterranean region.—An old favorite, recognized by the red-margined, short corona. A double form of this (Fig. 1462) is a pure white, a rare color amongst double narcissi.

1462. Double White Narcissus—N. alba plena ordorata, a form of N. poeticus (× ⅓).

Var. **radiiflòrus**, Burbidge (*N. radiiflòrus*, Salisb.). More slender and lvs. narrower: corona narrower and more erect: segments narrowed below so that they do not overlap. L. H. B.

Culture of the Narcissus.—Narcissi are among the oldest of cultivated plants, but were much neglected for many years. During the last two decades there has spread a renewed interest in the family, with the usual result in such cases that the habitats have been closely searched for new forms, and new hybrids have been raised till we have now a surprising number of beautiful flowers available. Recently many of these have become so plentiful that they are within reach of the most impecunious gardener, and there is no reason why American gardens should not be filled with good collections of these beautiful flowers, or why florists should not force a more interesting list. With few exceptions the Narcissi are hardy and strong-growing under ordinary cultivation. The "bunch-flowered" or Polyanthus Narcissi and Corbularias are better grown under glass. The Moschatus varieties, which are white (or properly sulfur-white) forms, seem to be of rather tender constitutions in most gardens. Otherwise the Narcissi as a rule succeed in good turfy loam, but no manure, rotted or otherwise, must touch the bulbs. Of course drainage should be good, and moisture plentiful in growing season. In the garden it is well to plant the bulbs say 6 or 8 inches deep, and 3 inches at most apart, and allow them to remain till they form strong groups, or till they show signs of too much exhaustion from numerous offsets. As decaying foliage is unsightly in the garden, a good plan is to dress the beds in the fall with some rich manure, either animal or chemical, and in early spring start seedlings of annuals to cover the beds when the Narcissi are through flowering, the dressing being necessary for the sustenance of the double crop. Too strong a cultivation of the Narcissi is not to be recommended, an extra vigor of growth being detrimental to the purity of the color of the flowers. If the object is to increase one's stock as quickly as possible, biennial or even annual lifting and separation of bulbs is advantageous. For naturalizing in waste places, in the grass, or near water, many of the strong-growing kinds will succeed perfectly. What to select is somewhat experimental for, as every gardener knows, plants equally hardy and vigorous will not grow in every garden.

The proper time to plant is in late summer or early fall, and the Poeticus kinds should not be kept out of ground longer than possible; knob-like excrescences at the base of the bulbs indicate that growth is commencing and that planting should not be delayed. All Daffodils force easily after being well rooted, and should be brought on in a moderate temperature, as they are naturally low temperature plants—so much so, in fact, that in the open the flowers are very apt to be ruined under our sunny skies, especially if exposed to drying winds. A most satisfactory planting of Narcissi for house decoration is the use of flat lily pots, say 8 inches in diameter, placing the bulbs closely together. The flowers carry best and keep better if cut when half open.

The intending collector will perhaps be confused when he opens a list of say 200 varieties, and it may be as well to say that a moderate commencement may be made by selecting a few of each section into which these are usually divided in good lists, bearing in mind that price is not an indication of the beauty or usefulness. As a matter of fact, the lower price is usually an indication that these are not uncertain and are probably more valuable in the garden. There are a few forms, such as *N. Horsfieldii*, Emperor Maximus, Mrs. J. B. M. Camm, Stella, and all forms of Poeticus, which no well-constituted garden should be without, but one can scarcely go amiss. J. N. GERARD.

In Europe, the Narcissus, next to the tulip, is the most extensively grown and popular of the spring-flowering bulbs for outdoor culture. Probably owing to many varieties not proving hardy in our climate of extremes of temperature, it has never occupied the position it deserves in American gardens. Though many varieties are not hardy here, there are enough that can be successfully grown to make them among the most desirable of our spring-flowering bulbs. Though our hot suns ripen them much faster than in the equable climate of Britain, still a good selection of varieties will produce a greater profusion of bloom for a season of five weeks than any of our bulbous plants.

Most varieties are very accommodating in the matter of soil, succeeding well in any good garden that is not very sandy or a stiff clay, but good drainage is always essential. As they can occupy the same place for five or six years, it is well to prepare the bed by deep digging and liberal fertilizing with well-rotted stable manure. The bulbs should be planted from 4 to 5 inches deep from the upper end of the bulbs to the surface.

and from 4 to 6 inches apart. Those that increase slowly, as the Trumpet varieties, should be 4 inches, and the more vigorous Poeticus and Incomparabilis sorts should be at least 6 inches apart, as they increase so rapidly that in five or six years they will occupy the whole space. No variety should be disturbed till the bulbs are so crowded that they force themselves to the surface.

In the northern states and Canada plant in September, as soon as the bulbs arrive from Europe, or during the month of October, not later; after the end of October the bulbs cannot make roots enough before winter to produce good flowers the following spring. As soon as the surface of the soil is frozen, cover with strawy stable manure 4 to 6 inches deep, which should be raked off and removed as early in the spring as possible. After flowering, the foliage should be allowed to die naturally each spring; if cut off when green the bulbs do not ripen properly, and the flowers next season are inferior in quality; no seed pods should be allowed to form. When cutting for house decoration, cut as soon as the flower bud opens; the flowers last much longer than if exposed to the sun after opening. If specimens are to be mailed to a friend, cut before the bud opens; they will travel much safer, and will open out perfectly when put into water.

All the Poeticus varieties are perfectly hardy, and profuse bloomers, except *Alba plena odorata*, which cannot stand the hot suns of our average climate, and which blooms freely only in a cool, wet season. Most years the flowers are formed, but the spathe does not open. *N. poeticus*, with white perianth and reddish purple crown, is the sweetest perfumed and freest bloomer of all Narcissi, and should be in every garden. Its season is the last half of May. *Poeticus ornatus*, not so sweet perfumed, but a larger and showier flower, has a perianth of the purest white and an orange crown, in bloom the first half of May. Another very handsome form is *biflorus*, white, with pale yellow crown, flowers always in pairs, season about the same. The type *Burbidgei* and its numerous varieties are all desirable, but the above three kinds are the best of the short-crowned section.

The medium-crowned Narcissi, including *N. incomparabilis* and the hybrids *Barri, Leedsi, Humei, Nelsoni*, etc., is the largest of the three sections, many dealers offering over one hundred varieties. They are all, with the possible exception of *N. Humei* varieties, quite hardy and very desirable garden flowers, many of them increasing as rapidly as *N. poeticus*. The prevailing color is yellow in varying shades; sometimes the perianth is white, though never so pure a color as *N. poeticus*. They vary in size from the dainty little *N. Leedsi elegans*, white, with a pale yellow crown, to the Giant Sir Watkin, golden yellow, with a darker crown, a magnificent flower that should be in every collection. Other very satisfactory sorts are Stella, Cynosure, Sunray, Circe and Golden Gem. The best doubles in this section are double Incomparabilis, a very free bloomer, and Sulphur Phœnix, the most beautiful of all double Narcissi.

The large-crowned or Trumpet Narcissi are the most elegant and beautiful of all spring flowers. Unfortunately they have not the vigor or adaptability of the other sections, and most of them die out after two or three years' struggling against the unfavorable conditions of our climate; but many of them are so low in price now that they are well worth a place in the border even if they have to be replanted every two or three years. They are divided into three groups: (1) Yellow-flowered, in which the perianth and trumpet are both yellow, though sometimes of different shades. In this group Obvallaris and Emperor (a large flower) are quite hardy, while Golden Spur, Henry Irving, Trumpet major, Trumpet maximus, Shirley Hibbard, Countess of Annesley and Von Sion, all splendid flowers, bloom well the first spring, indifferently the second, and generally die after the third year, except under very favorable conditions. (2) The Bicolor group, in which the perianth is white or pale primrose and the trumpet deep yellow; among the whites Horsfieldii, Grandis and Empress are quite hardy and very beautiful. The best of the primrose perianths is the well-known Princeps, so cheap that it should be largely planted in every garden for cut-flowers. *N. bicolor, Pseudo-Narcissus Scotticus* and Michael Foster are not quite hardy. (3) The white-flowered, in which both perianth and trumpet are white, though generally with a tinge of sulfur. None of this group are quite hardy. Most of them are too expensive to plant for one season's bloom, but *Moschatus, Moschatus albicans* and *Pallidus præcox* are low enough in price to be worth trying. The well-known double Von Sion, so extensively forced by florists, is not quite hardy in the Canadian garden. It blooms well the first year, and sometimes the second year, but in the third or fourth year it turns green in color and gradually dies out.

None of the Polyanthus Narcissus, Jonquils, or Hoop-Petticoat Daffodils (*N. Bulbocodium*) are hardy enough to be worth planting in the colder parts of the northern states or Canada, unless in very favorable locations.

Pot Culture. — All varieties of the Narcissus are suitable for pot culture. Those of the Poeticus section require careful handling for success, but all the other kinds are of the easiest culture. Especially desirable for their beauty and delicious odor are the Jonquils, single and double, *Odorus rugulosus* and the Polyanthus or bunch-flowered Narcissus, the best known of of which are the Paper White and the so-called Chinese Sacred Lily.

The large-flowered sorts may be planted three in a 5-inch pot, and the smaller bulbs, as Jonquils and Bulbocodiums, five in a 5-inch pot. Set the bulbs with the neck at the surface. The soil and treatment given hyacinths will ensure success. If enough are planted to bring fresh pots forward every two weeks, a continuous succession of bloom can be maintained from December to May.

R. B. Whyte.

NARTHÈCIUM (an anagram of Anthericum, from the Greek Antherikos, supposed to have been the Asphodel). *Liliàceæ.* Bog-asphodel. About 4 species of perennial rhizomatous herbs, with linear, equitant basal lvs., wiry, erect, simple stem, and terminal racemes of yellow fls. Natives of Eu., E. Asia, Atlantic States and Calif. Stem 10 in.-2 ft. high: lvs. 3-8 in. long, 2 lines or less wide: fls. on bracted pedicels; bractlets linear; perianth of 6 narrowly lanceolate segments, reflexed or spreading in fl., soon erect, persistent; stamens 6; anthers 2-celled; stigmas small, terminal and slightly lobed: seeds numerous, ascending, with a long bristle-like tail at each end.

Califórnicum, Baker. Stem 1-2 ft. high: basal lvs. 1½-2 lines broad; cauline lvs. 2-3 in number, short: raceme 3-5 in. long, loose: fls. 30-40, yellowish green: capsules of paper-like texture, slender at top, 3-valved, when ripe a bright salmon color. Swamps, Calif. Introduced by dealers in native plants in 1888 or 1889.

M. B. Coulston.

NASEBERRY. See *Sapodilla.*

NASTÚRTIUM (classical Latin name of some cress, from *nasus*, nose, and *tortus*, distortion; referring to the effect of its pungency upon the nostrils). *Cruciferæ.* This genus includes the familiar Water Cress, *N. officinale*. It is too well known to need much description, and is of easy culture. (See *Cress.*) Water Cress is a hardy, aquatic, perennial plant, which grows in pure running water, and has a delightful peppery taste. It is much used for garnishing and for salads. The stems are spreading and take root at the lower joints. The lvs. are usually lyrately or pinnately parted and eared at the base: lfts. 3-11, more or less rounded and wavy: fls. small, white. An allied plant is the Common Winter Cress or Yellow Rocket (*Barbarea vulgaris*), but this is a dry land plant, with yellow fls. In the tropics *N. Indicum* is a desirable cress. This is an erect annual, with yellow fls. It is said to have been cult. in Europe, but Pailleux and Bois say it is useless outside the tropics. Nasturtium is a genus of 20 or more widely scattered species. They are herbs of various habit and duration, terrestrial or aquatic, glabrous or pubescent: lvs. entire or variously lobed or pinnatisect: fls. usually yellow: petals scarcely clawed, sometimes lacking; stamens 1-6: pods short or long; seeds usually in 1 series.

W. M.

NATIVE PLANTS. It has been said that Americans do not appreciate the indigenous plants of the country. This may have been true, but it is not true now. The desire for native and natural plants is one of the prominent movements of the present time. It is not strange that wild plants are not appreciated in a new country. The first necessity of our civilization was to fell the trees that ground might be tilled and habitations be built. The necessities of life were imported; the literature was exotic; the plants were transported from other lands. In Europe the conditions of living had become established. People had outgrown the desire to remove. They appreciated their own plants and also those from the New World. American plants attracted attention in Europe rather than in America.

Ten years ago, the writer made a census of indigenous American plants which were known to have been introduced to cultivation. The statistics were published in "Annals of Horticulture for 1891." It was found "that there are in North America, north of Mexico, about 10,150 known species of Native Plants, distributed in 1,555 genera and 168 families. Of these, 2,416 species are recorded in this census, representing 769 genera and 133 families. Of this number, 1,929 species are now offered for sale in America; 1,500 have been introduced into England, of which 487 are not in cultivation in this country." All these species are catalogued in the census. The only other account of the entire cultivated flora is that which is contained in this Cyclopedia, and for which the lists of ten years ago were a preparation. The final summing up of these volumes will show an increased number of Native Plants in cultivation in this country. A brief sketch of the history of recent efforts towards the introduction of Native Plants is given in the preface to the census above mentioned.

Formerly, the term "American Plants" had a technical meaning in England. William Paul in his book on "American Plants," published in London in 1858, writes as follows: "The history of American plants may be briefly told. The term is popularly applied to several genera, principally belonging to the natural order Ericaceæ. They are generally 'evergreen,' producing their flowers for the most part in the months of May and June." The book is devoted largely to rhododendrons, azaleas and kalmias, although European and other heaths are included.

There is a strong tendency towards the production of peculiarly American types and races even in Old World domesticated species, as of the carnation and sweet pea. As American plant-breeders come to give greater attention to native species, the divergencies between the horticulture of the Old World and that of the New World will be accentuated.

L. H. B.

NAUMBÙRGIA (after Naumburg). *Primulàceæ.* SPIKED LOOSESTRIFE. A monotypic genus of the north temperate zone, with opposite lvs. and fls. in short, axillary, peduncled spikes; corolla 5–7-parted, rotate; stamens 5–7, opposite the divisions of the corolla: capsule 1-loculed; seeds several on a central placenta. Differs from Lysimachia in the spiked flowers, nearly separate stamens, and the presence of tooth-like staminodia.

guttàta, Mœnch (*Lysimàchia thyrsiflòra,* Ait.). Erect, perennial herb, 1–2½ ft. high: lvs. lanceolate, acute, narrowed at the base, lower cauline scale-like: fls. 2–3 lines broad, yellow, purple-dotted; lobes of the corolla linear-oblong. May–July. Swamps. B.M. 2012.—Grows best in shallow water.

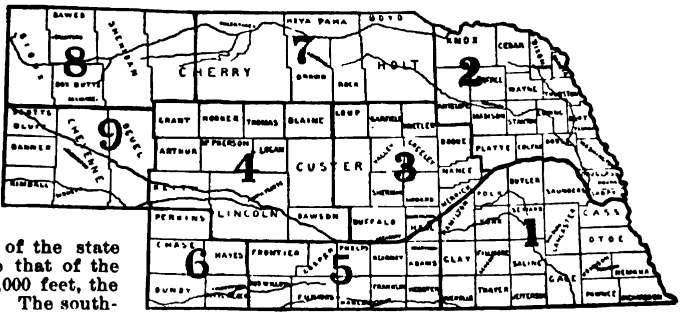
K. M. WIEGAND.

NEBRASKA, HORTICULTURE IN. Fig. 1463. The state of Nebraska presents somewhat peculiar horticultural conditions. It consists, for the most part, of gradually rolling prairies, slowly ascending toward the northwest The elevation of the southeastern part of the state is about 900 feet above sea-level, while that of the extreme northwestern part approaches 5,000 feet, the highest points somewhat exceeding that. The southeastern portion is rolling and broken, even rough in places, but affords the best general horticultural conditions. This is in part owing to soil and the possibility of more favorable sites, in part to the milder climate, and in part to the heavier rainfall of the region. The central part of the state is more even in surface, and subject to a high rate of evaporation from dry summer and winter winds, therefore less favorable. Beyond the prairies, to the westward, lie the sand-hills, which are in turn followed by the buttes and Bad Lands of the extreme western part. West of the 100th meridian fruit-growing of all kinds is difficult and uncertain, though, as the conditions come to be better understood and guarded, planting is being pushed farther and farther westward. As irrigation develops, fruit will be far more grown than now.

Commercial orcharding under irrigation is just beginning in the western and central portions of the state. According to E. F. Stephens, of Crete, Neb., who has closely followed its development, only about 300 acres have been planted, the largest number being in Lincoln county, which has about 180 acres. A beginning is also being made in small fruits under irrigation. Shipping facilities are excellent, since several fast freight lines already run through the state.

The State Horticultural Society has divided the state into nine fruit districts, which are very generally recognized in the discussions and recommendations of the society. These districts are indicated on the accompanying map. They are known, in the order numbered, as the (1) Southeastern, (2) Northeastern, (3) East-central, (4) West-central, (5) Lower Republican, (6) Southwestern, (7) Lower Niobrara, (8) Northwestern and (9) Western districts. In the revised fruit list published by the society, apples are recommended for general planting in Districts Nos. 1 and 2, and for trial in the balance of the state. Peaches are recommended for general planting in District No. 1 and for trial in Districts Nos. 5 and 6. Plums (native varieties) and cherries are recommended for Districts Nos. 1, 2, 5 and 6, and for trial in the balance of the state. Black raspberries are recommended in Districts Nos. 1 and 2, and for trial elsewhere. Grapes are recommended in Districts No. 1, 2, 5 and 6, and for trial in the other districts.

The fruits which thrive best in the state are apples, native plums, sour cherries and, in the southeastern part, peaches. Extensive apple orchards occur adjacent to the Missouri river, both north and south of the Platte. In some respects the methods in vogue differ from those in the eastern states. The trees are shorter-lived and are planted closer. Low heads are commonly employed as a means of protection against the high winds and intense sun, but this practice is not uniform. Trees demand less pruning than in the East, for the climate is dry and the sunlight so intense that fruit colors well even in shade. This is one of the reasons why low-headed trees prove satisfactory. Fungous diseases seldom cause serious trouble. In a series of wet years the apple-scab becomes noticeable, but it is usually conspicuous only by its absence. Among insect enemies, the codlin-moth is particularly troublesome, because several broods appear during the long, warm summer. The apple-maggot and bud-moth have not yet become prevalent. Apples tend to mature early, and most varieties do not keep well. The chief problem is the one of water supply; hence



1463. The Nine Pomological Districts of Nebraska.

thorough, continuous cultivation becomes imperative, though in the river counties some measure of success may be attained without it. In varieties the Ben Davis leads all others for market purposes. It is a large apple which yields well, colors well, keeps well and ships well. Thus far it has always sold well in market, notwithstanding its poor quality. It is, therefore, the Nebraska apple which far out-distances all competitors. Other varieties of prominence are Winesap, Janet, Wealthy, Grimes, and Jonathan. Duchess is the leading summer apple.

In the 100-acre orchard of E. T. Hartley, Lincoln, lath screens are used to protect the trunks from the fierce heat of the afternoon sun. The orchard is ten years old, and Mr. Hartley reports that the entire expense, including ground rental value, interest, replantings, and all the operations necessary to extensive culture has not exceeded $1 per tree. The cost of cultivation has been greatly reduced by the use of a broad, heavy cutting-blade devised by Mr. Hartley, which is attached behind the disk-harrow. This implement takes everything clean and leaves a fine, loose mulch on the surface. By its use 140 acres of orchard, containing nearly 12,000 trees, were kept in perfect condition from the latter part of April to the middle of August in 1898, an unusually wet and weedy season, at a cost of about $225, or less than two cents per tree.

The native plum thrives well over a wide range of the state. Some varieties suffer from the plum-pocket disease, and the plum-gouger is a troublesome insect, but the results are generally good. The leading varieties are Wild Goose, Miner, DeSoto, Wolf, Forest Garden and others. European varieties have been little planted as yet, though they succeed in the eastern portion of the state.

Cherries also thrive over a large part of the state. The fruit is sometimes deficient in size, but is remarkably free from insect attack, a wormy cherry being almost unknown. Early Richmond, Montmorency, and English Morello are the leading varieties. Sweet cherries do not thrive.

J. M. Russell & Son, of Wymore, on the southern boundary of the state, have made a decided success of peach-growing, and now have about 265 acres planted at Wymore and near Lincoln, 80 acres of which are in bearing. In 1896 they harvested 12,000 bushels. They head low, prune but little, and give thorough tillage during the early part of the season. Among the varieties which prove most satisfactory are Alexander, Hale Early, Early Rivers, Cooledge Favorite, Champion, Hill Chili and a variety locally known as Wright. The early varieties are particularly satisfactory, owing to comparative immunity from rot.

Among the smaller fruits, grapes thrive, but require more bearing wood than in the East and generally yield less. The leading eastern varieties are popular. Raspberries and blackberries suffer from drought. They may be grown for home use, but do not yield satisfactory commercial crops without water. The same is true of strawberries. Currants and gooseberries thrive, the latter yielding well, though the fruit is not large. Currants commonly yield but little, but under irrigation excellent results have been obtained.

The nursery interests of the state are important. The actual acreage of nursery crops is estimated at about 500 acres. Apple trees, and especially apple seedlings, are largely grown. Root-grafting is the method used in their propagation. This is partly because trees on their own roots are found best adapted to the conditions prevailing on the plains and partly because the weather is likely to be unfavorable at the time of budding.

Gradually, floriculture and ornamental gardening are increasing, particularly about the cities. Because of the clear climate, greenhouse work must become popular as soon as better markets develop. Seed-growing has already made the state considerable reputation.

Fred W. Card.

In the eastern third of Nebraska, conditions are practically the same as those prevailing in Iowa and central Illinois. The most trying condition which has to be guarded against by the orchardists is the scant supply of water during the winter time which leaves the soil, which is naturally light and porous, so dry that the trees are frequently winter-killed or injured. The rainfall during the growing seasons averages about the same as that of Ohio, while the rain-fall during the entire year is very little over one-half that of the latter-named state.

The greatest need to insure better results for the fruit-grower is a better stock for plums and cherries. The Myrobalan and the Mahaleb are both widely used, but neither is adapted to the dry winters, and an earnest effort is being made to substitute in place of these something which shall be better fitted for the conditions. More or less has been done in the way of experimentation as to the use of the Sand Cherry, in the sandy parts of the state, as a stock, and with some degree of success. The effect of this stock is to dwarf the trees somewhat but not to a much greater extent than does the Mahaleb. The native plum is by far a better stock than the Myrobalan, but the period during which it may be budded is very short, and it is, consequently, very hard to use. On the other hand root-grafting of the plum is a process which has never come into very great use by reason of the small percentage which the average propagator is usually able to make unite and grow.

Root-grafting is practically the only method of propagating the apple, by reason of the fact that the work may be done at a time in winter when there is little else to do, and because the process can be carried on much more rapidly than budding. There is the further very important reason that trees grafted on piece-roots grow practically as cuttings, thus securing the tree on its own roots, lending on an average much additional hardiness.

Grapes thrive extremely well, especially in the eastern portion of the state. In the vicinity of Omaha, Plattsmouth and Nebraska City, many vineyards are established on a mercantile scale following the lead of the other very large growers located just across the Missouri river in Iowa.

Raspberries and blackberries produce profitable crops in the eastern and especially in the southeastern portion of the state.

Strawberries usually produce good crops of fruit of the highest quality. As a commercial venture very little has been done in growing the small fruits, by reason of the fact that in north Arkansas and southern Missouri, where the season is much earlier, immense quantities are produced with which all the state, practically, is supplied long before the home product is mature.

Currants and gooseberries are indigenous and thrive well in the eastern portion of the state, but bear less bountifully toward the west.

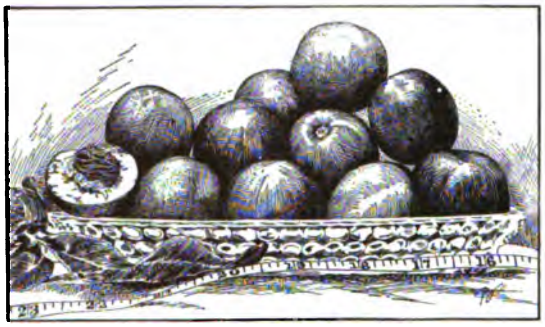
Wherever irrigation has been practiced, even on a small scale, anywhere in the state, the success in the growth of fruit has been very marked. In the parts of the state where there is insufficient rain-fall, the addition of water is all that is required to bring satisfactory results, the soil, except in the sand-hill portions of the state, being extremely rich.

In the early days of the territory and state the thickets and wooded strips along the streams were abundantly supplied with plums of delicious quality, two or three species of the grape, and the wild crab. There were also to be found, occasionally, gooseberries, currants and mulberries. F. W. Taylor.

NECTARINE. A smooth-skinned peach (*Prunus Persica*, var. *Nectarina*). Fig. 1464. Formerly it was thought that the Nectarine was a distinct species of plant. By DeCandolle it was called *Persica lævis*. Roemer in 1847 made two species of it, *Persica violacea*, the freestone Nectarines, and *P. lævis*, the clingstone Nectarines. It is now known, however, that Nectarines often come from seeds of peaches, and peaches have come from seeds of Nectarines. Either may originate from the other by means of bud-variation. (See Darwin's "Animals and Plants under Domestication" for historical data.)

The cultivation of the Nectarine is in all ways like that of the peach. Because of the smooth skin of the fruit, it is perhaps more liable to the attacks of curculio. It is less popular in the market than the peach, and therefore is less grown, although in California it is planted on a commercial scale. In that state it does well on almond stocks. Nectarines are usually inferior to peaches in quality, probably because less attention has been given to the breeding and selection of varieties, and from the fact that there is no conventional standard of excellence. Nectarines thrive wherever peaches do. Varieties are few, as compared with peaches. The most prominent in this country are Boston, Downton, Hardwick, Early Newington, Pitmaston Orange, Stanwick, Humboldt, Lord Napier, Advance, Elruge. In color, size and season, Nectarines vary as peaches do. See also *Peach*, and *Forcing*.

L. H. B.



1464. Nectarines.

The Nectarine is grown in California almost exclusively for drying and canning, and even for these uses is but of minor importance. As compared with peaches for canning, the product of Nectarines is only about one-eighth of one per cent that of the peach, and for drying only about one per cent that of the peach. The varieties grown for both canning and drying are the white varieties, because they do not color the syrup in canning, and because when sulfured they make a beautiful, amber-colored, translucent product.

E. J. WICKSON.

NEGRO'S HEAD. Unusual name for the ivory-nut palm, *Phytelephas macrocarpa*.

NEGUNDO. For *N. aceroides*, *Californicum* and *fraxinifolium*, see *Acer Negundo;* also Fig. 254.

NÈILLIA (named after Patrick Neill, at the beginning of the nineteenth century secretary of the Caledonian Horticultural Society at Edinburgh). *Rosàceæ*. Small, deciduous shrubs, with alternate, stipulate, usually 3-lobed lvs. and rather inconspicuous whitish fls. in simple or panicled racemes at the end of the branches. The one species in cultivation is not hardy North; it requires protection even in the Middle States, and is often killed to the ground in severe winters, but usually vigorous young shoots spring up and bloom and fruit in the same season. On account of its handsome bright green foliage it may be used as a border plant for shrubberies. It grows in almost any moderately moist soil. Prop. easily by greenwood cuttings under glass, and also by seeds. Seven species in the Himalayas and China. Fls. in racemes, with the pedicels shorter than the bracts; calyx-tube rather large, campanulate or almost tubular, with 5 erect sepals exceeding the 5 oval petals; stamens 10–30; carpels 1 or 2: pod dehiscent only at the inner suture, with several shining seeds. From Spiræa it differs, like the allied genera Physocarpus and Stephanandra, by its stipulate lvs. and shining crustaceous seeds.

thyrsiflòra, D. Don. Upright shrub, to 6 ft. high, but usually not exceeding 2 ft. if annually killed to the ground: branches angular, glabrous: stipules rather large, serrate: lvs. ovate, cordate at base, long-acuminate, usually 3-lobed, incised-serrate, glabrous above, pubescent only on the veins beneath, 2–4 in. long: fls. in panicled or sometimes solitary racemes; calyx-tube campanulate, pubescent, with the sepals about ⅛ in. long. Aug., Sept. Himalayas. R.H. 1888, p. 416.

N. Amurénsis, Nichols.=Physocarpus Amurensis.—*N. opulifòlius*, Brew. & Wats.=Physocarpus opulifolius.—*N. Tanákæ*, Franch. & Sav.=Stephanandra Tanakæ.—*N. Tórreyi*, Wats.=Physocarpus monogynus.

ALFRED REHDER.

NELÚMBIUM. The prior name is *Nelumbo*.

NELÚMBO (Ceylonese name). *Nymphæàceæ*. Usually written *Nelumbium*. Two species of strong-growing aquatics, one yellow-flowered and native to N. America, the other white or cyanic-flowered and native of the Orient. From Nymphæa, or the true water lilies, Nelumbo differs technically in having distinct carpels (which are imbedded in the receptacle), with a single ovule in each. Nelumbiums have strong and thick and usually tuber-bearing rhizomes, which creep in the earth in the bottoms of ponds and slow streams: lvs. peltate, orbicular or nearly so, entire, usually very large and long-petioled and mostly standing high above the water (sometimes floating): fls. large and showy, single, on peduncles which equal or exceed the lvs.; sepals 4 or 5; petals many, erect or erect-spreading; stamens many, on broad, short filaments: fr. a large, flat-topped perforated receptacle (Fig. 1465), in which are immersed the many carpels.

Nelumbiums are bold plants, suitable for large ponds and for masses. The oriental species, commonly but incorrectly known as Egyptian Lotus, is one of the best of large pond plants, being grown for its stately habit and showy flowers. Its roots should not freeze. Covering the pond with boards and litter, or filling it with water, may be made to afford ample protection to the roots.

A. *Fls. yellow.*

lùtea, Pers. AMERICAN LOTUS, or NELUMBO. WATER CHINKAPIN. Lvs. usually raised 2–6 ft. out of shallow water, cupped or depressed in the center over the attachment of the petiole, 1–2 ft. across: fls. pale sulfur-yellow, 4–10 in. across, with obovate-obtuse concave petals and hook-appendaged anthers: root-tubers and seeds edible. In ponds and slow streams from S. Ontario and Mich. to Fla. and La.; usually local. Mn. 10:113.—A bold and useful plant for colonizing, deserving to be better known.

AA. *Fls. pink, red or white.*

nucífera, Gærtn. (*Nelúmbium speciòsum*, Willd. *Nelúmbo Indica*, Pers., and *N. Nelúmbo*, Karst.). INDIAN LOTUS. Fig. 1465. Lvs. usually larger than those of *N. lutea*, glaucous: fls. fragrant, usually pink except in horticultural varieties, overtopping the lvs. Warmer parts of Asia and N. Australia. Gn. 28, pp. 426, 429; 43, p. 463; 44, pp. 229, 435; 50, pp. 267, 469. G.M. 38:809; 40:24; 41:833–5. I.H. 42:27. Gng. 5:114; 6:295; 15:334.—This plant is known to the trade as Egyptian Lotus, but the Lotus of the ancient Egyptians is a Nymphæa. This plant is not native to the Nile region. There are many named forms in cult. Var. **álba** (*N. álbum*, Hort.), the "Magnolia Lotus," has white fls. Gn. 28, p. 427. G.C. III. 14:41. A.G. 20:369. Gng. 7:146. A.F. 14:726. Mn. 9:73. Var. **kermesìna**, Hort., has light pink fls. Var. **ròsea**, Hort., has rose-colored fls. There is a striped form known as var. **álba striàta.** A large double rose form is **ròsea plèna.** A large double white form is known in the trade as *N. Shiroman* (F.E. 10, Suppl. Feb. 12). A free-flowering early sort with white fls. shaded pink is *N. Kinshiren* of the trade. There are other forms with Latin names.

L. H. B.

Whilst it may be historically true that the Egyptian Lotus is not a Nelumbium, the *Nelumbium speciosum* (or more properly *Nelumbo nucifera*) is everywhere known under that name, and it has been so distributed in good faith. In fact, it is doubtful if it is worth while to change the common name at this time.

America may be honestly proud of possessing such a fine aquatic plant as *Nelumbo lutea*, the well-known American Lotus. While China and Japan are the recognized homes of the splendid *Nelumbo nucifera*, they do not possess a yellow Lotus. In the Central states and near the Great Lakes, *N. lutea* is found in abundance, but it is scarce in the Middle Atlantic and Eastern states. Where well established it is a magnificent plant, and when in blossom it is a sight worth traveling miles to see.

Nelumbiums, with Nymphæas and other aquatic plants, were among the few flowers known or cultivated by the ancients. No mention is made in history of a yellow Lotus prior to the discovery of America by white men, but over four centuries ago it was well known to and cultivated by the Indians in the waters of the Tennessee and Cumberland rivers, and was abundant on the tributaries of the Mississippi. It was carried northward and eastward by the Indians, and was established as far east as Connecticut. At the present time (1900) it is established and cultivated in most of the states of the Union.

The late Isaac Buchanan received tubers of *N. nucifera* from Japan, which were planted in a stream on Long Island, but there they perished. Later other efforts were made, and some tubers from the same source were received and planted by Samuel Henshaw in an artificial pond in the gardens of the late Mr. Green, at New Brighton, Staten Island, N. Y., where they grew most satisfactorily, some of the original stock being still in evidence on the estate.

About the same time E. D. Sturtevant, of Bordentown, N. J., who had introduced a number of tender water lilies into commerce, and knowing of its being grown in the Jardin des Plantes, Paris, made an examination of the condition under which it existed there and determined to experiment in the culture at Bordentown, N. J. Roots were obtained from Kew Gardens and afterward planted in shallow water in a sheltered spot in a mill-pond near Bordentown. Here the plant grew amazingly, and its success and hardiness were fully established. From here was disseminated the now famous Egyptian Lotus, *Nelumbo nucifera*, to all parts of the United States. Several varieties have since then been introduced from Japan, including white and delicately tinted varieties, also deep rose, and double forms of both white and rose.

1465. The Indian Lotus. Nelumbium speciosum of the trade, but properly Nelumbo nucifera.

The cultivation of the Nelumbium is of the simplest. The roots or tubers should not be transplanted until there is evidence of growth, as the tubers, being usually buried deep in the soil below the water and out of the reach of frost, are not affected by the warm rays of sunshine as early as Nymphæas and other terrestrial plants. If Nelumbiums are dug before they start into growth, the tubers should be kept in a warm place or planted where the temperature is such that growth will begin at once. In the Middle Atlantic states and eastward and westward, May is the best time to transplant; southward earlier. Tubers may be planted in shallow water near the margin of the pond where it is intended they shall grow. The tuber should be placed horizontally in the soil, first making a little trench or opening to receive the same and covering with about three inches of soil. Means must be employed to keep the tuber securely in position and, if necessary, a stone or brick laid over the tuber. In artificial ponds a walled section should be built to hold the soil and keep the roots within bounds. The walls should have no corners at right angles; where there are such they should be rounded off, so that the runners are not intercepted and crowded in bunches at the corners. The natural soil and deposit in ponds are, in most cases, all that is required for these plants. They will flourish equally well in a stiff or tenacious soil, but when grown in artificial ponds it is best to use a mixture of two parts turfy loam and one part thoroughly rotted cow manure. Do not use fresh or green manure, and when possible have sods cut in the fall and stacked with the manure (in this case it may be fresh). In early spring have the same turned over two or three times before using. Resort may be had to cultivation in tubs, but the Lotus being such a gross feeder the result in most cases is that the plants are starved into rest at an early date. The leaves turn a sickly yellow and present a sorry appearance, and in many cases produce no flowers. If no other method can be adopted, then secure the largest tubs possible and during the growing season use liquid or artificial manure liberally.

It must be understood that while the Nelumbiums are hardy, they are only so as long as the tubers are out of the reach of frost. The depth to which frost penetrates the soil or water may be termed a dead line.

The tubers are farinaceous and edible, and are of considerable market value in Japan, but a taste must first be cultivated for them in the United States. The muskrat, however, has developed a highly cultivated taste for these sacred morsels, and it is necessary to watch these animals lest they take up their abode near ponds where the Nelumbiums grow. There are now in cultivation in the United States a dozen or more varieties, including single and double forms, pure white to deep rose, and yellow.

As to insect pests, black-fly or black aphis is sometimes troublesome. The best remedy is the lady-bird beetle and its larvæ. The leaf-cutter, or roller, is prevalent in some sections, and both young and old leaves are attacked, also the stems of the leaves and flowers. These have their natural enemies in the form of wasps and even sparrows, and as no liquid insecticide can be used, only such as are in the shape of a dry powder can be depended on. Paris green, mixed with land plaster or plaster and powdered slake lime, is excellent, but dry hellebore in powder-form, applied by a powder bellows is the best material to exterminate them.

Wm. Tricker.

NEMÁSTYLIS (Greek, *thread-like styles;* because the styles are not united). Syn., *Nemastylus*. *Iridàceæ*. A few species of tender American bulbs, with blue 6-lobed fls. about an inch across which last only a day. Strictly Nemastylis is a genus of 3 species, found only in the southern U. S. and characterized by having the filaments nearly free. Baker, however, in his Handbook of the Irideæ, includes Chlamydostylis as a subgenus of 14 species found from Mex. to S. Amer. and characterized by having the filaments united in a column to the summit.

Generic characters are: root-lvs. linear: spathes 1 or more, peduncled: fls. more than 1 to a spathe; perianth without a tube; inner segments a little smaller than the outer: ovary 3-celled; ovules many, superposed; style branches alternate with the anthers; capsule loculicidally 3-valved. Some of the following species have been rarely advertised by dealers in native plants; the others by Dutch bulb-growers.

A. *Filaments nearly free. Subgenus Nemastylis proper.*

B. *Cluster of fls. single: spathes usually 1-fld.*

cœléstina, Nutt. Root-lvs. 1–2, 1 ft. or more long: stem 1½–2 ft. long, bearing 3–4 reduced lvs.: fls. sky-blue. Pine barrens, Fla. to S. C. and westward.

BB. *Clusters of fls. 2–3: spathes 2–3-fld.*

acùta, Herb. (*N. geminiflòra,* Nutt.). Root-lvs. 2–3, ½–1 ft. long: stem ⅓–1 ft. long, bearing 1 large linear leaf at the fork, and sometimes another below it: fls. "bright blue." Tex., Ark. B.M. 6666. F.S. 21:2171.

AA. *Filaments united in a column to the summit. Subgenus Chlamydostylis.*

B. *Fls. brownish purple, inner segments tipped yellow.*

brúnnea, Wats. Stem bearing a single leaf 6–8 in. long and a sheathing bract at the base of the peduncle: spathe 2⅓ in. long: outer segments obtuse, inner ones acuminate. Mex.

BB. *Fls. pale blue.*

Pringlei, Wats. Stem usually simple, with a single leaf at the middle: spathe 1⅓ in. long: fls. fragrant; outer segments obtuse, inner ones minutely apiculate. Mexico.

W. M.

NEMÈSIA (old name used by Dioscorides for some sort of snapdragon). *Scrophulariàceæ.* One of the horticultural novelties is *Nemesia strumosa.* It is one of the most interesting annual fls. introduced in the last decade of the nineteenth century. The flowers are very distinct in shape and have a wide range of color. The fls. are about an inch across and borne in great profusion. If started indoors in March and transferred to the open in May the plants will furnish a continuous sheet of bloom from June through September. The colors range from white, through pale yellow and rose, to orange and crimson, with numerous intermediate shades and a great variety of throat markings. This species has been known to botanists nearly a whole century; it grows only 50 miles from Cape Town, and it exhibits all these colors in the wild, yet it was never exploited until 1893, the first live plants seen in Europe being shown in 1892. Sixteen distinct color varieties were recognized in the first batch of cultivated plants, and the process of selecting strains has barely begun. The lower lip of the flower is about twice as broad as long, and notched at the point farthest from the center of the flower. The upper lip consists of 4 smaller, nearly equal lobes, the side lobes being usually more nearly separate than the middle ones.

Nemesias are slender annual or perennial herbs, sometimes woody at the base: lvs. opposite: fls. in racemes at the tips of branches or rarely solitary in the axils; calyx 5-parted; corolla-tube short, with an anterior spur or sac: capsule compressed, septicidal, with navicular valves. About 30 species, all S. African. The following belong to the group with fls. in racemes. They are glabrous or nearly so, 1–2 ft. high, and branched from the base. J. N. Gerard thinks that Nemesias are not destined to become popular. He finds that the seed is likely to germinate poorly and that the young seedlings are quick to damp off.

A. *Fls. with a sac at the base.*

strumòsa, Benth. Root-lvs. oblong-spatulate, entire; stem-lvs. lanceolate or linear, entire: lobes of the upper lip relatively shorter and broader than in the next two species: throat with a long beard inside: lvs. few, the floral ones bract-like: capsules 4–6 lines long, 3–4 lines wide. B.M. 7272. G.C. III. 12:277. R.H. 1898, p. 87 (var. *grandiflora*). V. 16:7.—Var. **Súttoni** is the strain commonly offered. G.M. 35:459.

AA. *Fls. with a spur at the base.*

versícolor, E. Mey. Lowest lvs. stalked and ovate; upper lvs. few, sessile, oblong, lanceolate or linear, entire or toothed: lobes of the upper lip equal among themselves and as long as the lower lip; throat with 2 callosities, pubescent: spur incurved, about as long as the lower lip, 4 lines. Not advertised by name, but *N. compácta,* vars. *álba* and *cærùlea,* Hort., belong here. R.H. 1898, p. 87.

floribúnda, Lehm. Lower lvs. stalked, ovate, dentate; upper ones few, small, ovate or lanceolate, subsessile: lobes of the upper lip not quite as long as the lower lip: fls. white; throat lined with blue, the callosities of the palate yellow. According to De Candolle, the lobes of the upper lip are about equal among one another, but in B.R. 24:39 the middle lobes are narrower and longer than the side lobes. Advertised abroad. Fls. smaller and with a narrower range of colors than *N. strumosa.*

W. M.

NEMOPÁNTHUS (Greek words, referring to the thread-like flower-stalks). *Aquifoliàceæ.* MOUNTAIN HOLLY. A genus of one species, confined to eastern N. America. It is a medium-sized, hardy shrub, rarely cult. for its showy pendulous red berries, which are borne in autumn. The genus is distinguished from the common holly (Ilex) as follows: calyx often obsolete, especially in the fertile fls.; petals distinct, linear, acute; stamens free. (In Ilex the calyx is present and persistent in both fertile and sterile fls.: petals slightly grown together at the base, oblong, obtuse: stamens grown to the base of the corolla.) Nemopanthus is now largely used, and the plants attain 10 ft. in cultivation.

fasciculàris, Raf. (*N. Canadénsis,* DC.). Dense-growing, purplish barked shrub, attaining 6 ft.: lvs. often clustered on spurs, 1–1⅓ in. long, elliptical, mucronate, entire or minutely serrate, thin but firm: fls. about 2 lines wide: drupes dull red, about 3 lines thick. B.B. 2:393.

NEMÓPHILA (Greek, *nemos,* a grove, and *phileo,* to love; referring to the habitat of some species). *Hydrophyllàceæ.* Nine species of hardy annual herbs, all from N. Amer., are now referred to this genus. They are of dwarf, compact habit, and produce an abundance of showy bell-shaped fls. from early spring to late summer; hence they are valued for bedding and for the border. Whole plant more or less hairy: stem diffuse, becoming prostrate: lvs. alternate or opposite, pinnately lobed or divided, petiolate: flower-stalks usually longer than the lvs., terminal or lateral, slender, 1-fld.: fls. blue, white, purple, or variously spotted; calyx 5-parted; lobes erect or spreading, with 5 supplementary reflexed lobes alternating with them; corolla broadly bell-shaped or wheel-shaped, deeply 5-lobed, with 10 scaly appendages on the inside of the throat.

S. W. FLETCHER.

All the species are propagated by seeds sown in the fall or early spring. If plants are desired for very early flowering, seeds should be sown in Aug. out-of-doors and the plants transplanted in late fall; or they may be started under glass in March. Seeds sown in April in the open will give plants for summer and fall flowering. These are preferably transplanted. If a later sowing is made it should be where the plants are to flower. Most species seed freely, but they cannot be trusted to re-seed themselves satisfactorily. Nemophilas love a moist loam with partial shade, but accommodate themselves to any good garden soil and a sunny site. *N. Menziesii,* however, should be planted in a moist place if possible, and *N. aurita* is impatient of intense sun. Few hardy annuals are more valuable for bedding than Nemophilas because of their compact habit and free-blooming qualities. They are also fine for cut-flowers, window boxes and pot-plants. *N. insignis* and *N. Menziesii,* with their many garden varieties, are most popular.

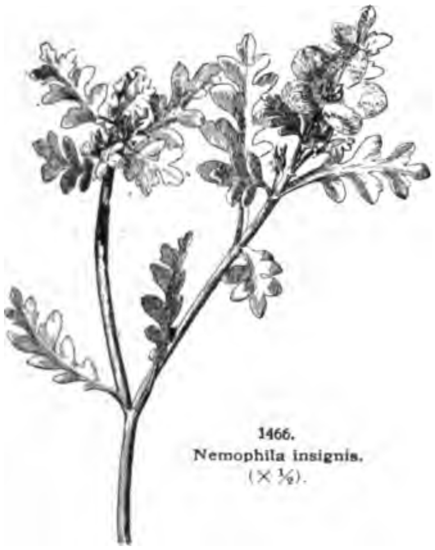
F. W. BARCLAY.

The above method of culture is not adapted to all parts of the country. It is very doubtful whether Nemophilas have ever been successfully grown outdoors during summer in the vicinity of Boston. The writer has tried them over and over again without success. His best results have been attained by growing them in pots in a cool greenhouse. Nemophilas are said to do beautifully outdoors in Maine, where the summer is cooler and moister. In Scotland, Nemophilas are esteemed most delightful garden plants. An odd thing about Nemophilas is that cats are extremely fond of rolling in them as they do in catnip.

Robert Cameron.

A. *Lvs. mostly alternate, all with an ear-shaped and clasping base or winged petiole.*

aurita, Lindl. Stem 1–3 ft. long, weak, with stiff, recurved bristles by which the plant tends to climb: lvs. deeply cut above into 5–9 oblong or lanceolate segments, which are usually turned back: later fls. not accompanied by lvs., and hence appearing to be in loose racemes; corolla about 1 in. broad, violet. Low, shady grounds. Calif. B.R. 19:1601.



1466. Nemophila insignis. (× ½).

AA. *Lvs. all opposite, base not ear-shaped.*

B. *Scaly appendages on throat of corolla narrow.*

Ménziesii, Hook. & Arn. (*N. atomària*, Fisch. & Mey. *N. discòidalis*, Lem.). Stem straggling, succulent: lvs. pinnatifid, the lobes ovate, nearly entire, slightly hairy: fls. light blue to nearly white, marked with dark brown spots towards the center. Low grounds, western Amer. B.R. 23:1940. B.M. 3774. P.M. 5:99. V. 2:267.—Under cult. the species has given rise to var. **discoidàlis** (*N. discòidalis*, Lem.), in which the spots on the corolla are confluent into a large, brownish purple eye. Garden forms of this are: var. **vittàta**, velvety black margined with white (Gn. 9:232); var. **élegans** (*N. atomària*, var. *élegans*, Hort.), fls. pure white, with chocolate center (V. 2:268), and var. **oculàta**, white, with purple center.

BB. *Scaly appendages very broad or roundish.*

C. *Fls. blue, with white center.*

phacelioides, Barton. Leaf segments obtuse, margin slightly ciliate: lower lvs. narrowed into a short petiole; lobes notched at end: corolla bell-shaped. Western N. Amer. B.R. 9:740. B.M. 2373.

CC. *Fls. white, with a purple blotch at the tip of each lobe.*

maculàta, Benth. Lvs. lyre-shaped, the 5–9 short lobes obtuse, entire; upper lvs. wedge-shaped, sometimes only 3-lobed: fls. 1–2 in. wide, showy; sometimes the purple blotch is poorly defined. Common in western and central Calif. P. M. 16:6. F. S. 5:431. R. H. 1849:201. V. 2:267.—Good garden forms of this are var. **álbida** and var. **grandiflòra**. Var. **variegàta** has variegated leaves.

CCC. *Fls. vivid blue (pure white or lilac in vars.).*

insignis, Benth. Fig. 1466. Lvs. pinnately parted into 7–9 oblong segments, which are sometimes 2–3-lobed or toothed: fls. ½–1 in. wide. Low ground, Calif. B. R. 20:1713. B.M. 3485. P.M. 3:151. V. 2:268; 5:168; 8:215. —There are many garden varieties of this desirable species. Among these are var. **grandiflòra**, with large, clear blue fls. (Gt. 34:370); var. **álba**, fls. pure white; var. **marginàta**, fls. blue, edged with white.

S. W. Fletcher.

NÉNGA (Malayan name). *Palmàceæ*. Two or three species of Malayan palms, one of which is cult. as *Areca pumila*. In Areca, however, the ovule is erect and fastened at the base, while Nenga belongs to a large group in which the ovule is fastened on the side and more or less pendulous. Nenga is distinguished from the 5 cultivated genera of this group (which are listed under Hedyscepe) by the following characteristics: staminate fls. with narrow sepals much surpassing the petals; stamens 6; anthers erect. Nengas are graceful spineless palms with erect, slender, ringed trunks: lvs. terminal, equally pinnatisect; segments linear, acuminate or obliquely 2-fid or 3-fid; margins folded back at the base; primary nerves sparsely scaly below; rachis 3-sided; petiole short; sheath cylindrical, strongly oblique at the throat: spadix with a short peduncle and slender pendent branches: spathes 2, the lower symmetrical, lanceolate, folded, 2-crested, the upper unsymmetrical, persistent, or lacking: bracts 3-fid.; bractlets scaly: fls. white: fr. ellipsoidal, smooth, reddish orange.

Wendlandiàna, Scheff (*Arèca pùmila*, Blume). Stem 10–20 ft. high, 2–3 in. in diam.: lvs. 8–9 ft., pinnate nearly to the base; pinnæ alternate, ensiform, acuminate, 2½ ft. long, ½–1½ in. wide, bright green, coriaceous, 2-ribbed: petiole slender; sheath sub-ventricose, 2 ft. long. Java.

Jared G. Smith.

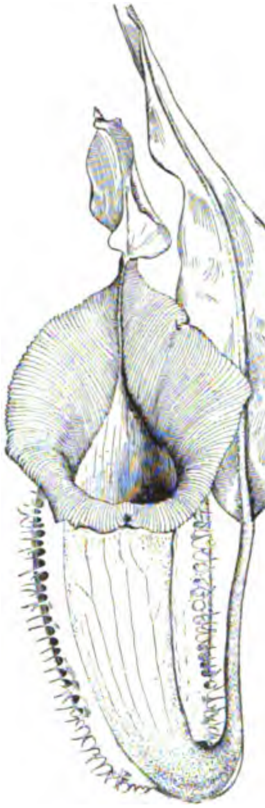
NEOTTÓPTERIS. Consult *Thamnopteris*.

NEPÉNTHES (name explained below). *Nepenthàceæ*. About 35 species of insectivorous pitcher plants which rank among the wonders of the vegetable kingdom. The word Nepenthes occurs in the Odyssey, where Helen threw a drug into the wine which was supposed to free men from grief, anger and all ills. In describing one of these pitcher plants, Linnæus said: "If this is not Helen's Nepenthes, it certainly will be for all botanists. What botanist would not be filled with admiration if, after a long journey, he should find this wonderful plant? In his astonishment past ills would be forgotten when beholding this admirable work of the Creator."

There are about 35 species of Nepenthes, all tropical and mostly Malayan. They are all remarkably alike, and different from anything else in the world. They are probably supported in part by animal matter which is caught in their pitchers. The fluid in the bottom of the pitchers is largely secreted by the plants and is comparable to the gastric juice. It helps to decompose and digest the food. The glands which secrete this digestive fluid may be seen with the aid of a hand-lens. This fluid is used by the natives of Borneo as a remedy for indigestion, as fresh ripe figs are often used. It has been analyzed and found to contain pepsin. It is secreted before the lids open, even in the baby pitchers, and the lid is believed to keep the rain from diluting the viscid fluid.

It is supposed that insects are attracted by nectar glands situated near the mouth of the pitchers, and perhaps also by the odor of the fluid. Later, the odor of decomposing flies is thought to attract flesh-eating insects, and thus a second harvest is secured. One species is said to be still further specialized in its tastes. Burbidge relates that *N. Veitchii*, from its peculiar habit of growing on dead trees, catches mainly such beetles and boring insects as exist in decayed timber, and ants innumerable. There is, however, a species of ant which outwits one of the pitcher plants; viz., *N. bicalcarata*. "This ant's object is water, and to obtain this it bores a hole through one of the large sugar-secreting glands of the stalk behind the pitcher, just below the water-line, seeming to know by instinct—or is it experience?—that the water of the pitchers so operated upon will well up the hole as it does in a syphon pipe." The two species of pitcher plants just mentioned are constantly robbed by insect-eating birds. The Borneans call the pitcher plants "monkeys' cooking pots." Burbidge was presented by the natives with delicious rice daintily cooked in clean pitchers of *N. Hookeriana*.

The pitchers of Nepenthes are borne at the ends of the leaves. They are usually flask-shaped, sometimes mug-shaped, rarely cylindrical. (For examples of these 3 shapes, see Figs. 1470–72.) A pitcher always has a lid, a mouth surrounded by a rim, a little spur at the back (which is usually just where the midrib of the back of the pitcher joins the lid) and two wings running up and down the front of the pitcher. The broader these wings and the longer their fringes the handsomer the pitcher, as a rule. The rim around the mouth sometimes bears numerous downward-pointing teeth, which have been supposed to turn back insect refugees.



1467. Nepenthes Veitchii.
Celebrated for its wide rim.

With the exception of about half a dozen very distinct types which will be mentioned later, Nepenthes species are too much alike. So far as records and pictures go, practically all the hybrids are as much alike as so many peas, at least so far as pitchers are concerned. A few exceptional kinds can be told by the hairiness or broad bases of their leaves, or by venation. Even the flowers furnish little help in distinguishing species and, as a rule, the cultivator wants pitchers, not flowers. The pitchers will "hold water," but it is doubtful if the present classification of them will. The difficulties of the case will be apparent from the following account of how the pitchers change in form and color as a plant develops.

How the Pitchers Change.—When a Nepenthes is grown from seed, the very first thing that develops after the cotyledons is a little pitcher. "These young pitchers," according to Harry James Veitch, "are at first continuous with the blade and form part of it; then sessile, and later separated from it by a prolongation of the midrib; they are produced simultaneously with the blade, not after it, as in the adult plant. * * * As leaves continue to be produced, so a gradual change in the size and shape of the pitchers becomes apparent. Instead of the pitcher being produced simultaneously with the blade, it lags behind, as it were; the midrib is perceptibly prolonged beyond the apex of the blade while the pitcher is still rudimentary, and this continues till leaves are produced with full-sized pitchers. If the stem is allowed to grow without check, the pitchers appended to the leaves successively produced undergo a change in shape and dimensions still more remarkable than what takes place during the progress of development from the infantine to what is regarded as the perfect form of the pitcher. * * * [See Fig. 1470.] As leaf after leaf is produced from the ascending stem, the pitchers first become longer and narrower; then follows a gradual diminution of the parts while the pitchers are being modified from the flask shape to the cylindric shape; the ventral wings constantly diminish in breadth and the ciliate fringe disappears until the place of the wings is denoted only by two narrow keels, and instances have been observed in which even these are obliterated. The pitchers not only undergo change in size, form and color, but they also change their position in respect to the prolonged midrib. By the time the seventh or eighth pitcher has been produced above that which we have already referred to as the perfect pitcher, the prolonged midrib has made half a revolution on its own axis, so that the pitcher has now its dorsal side toward it. As the pitchers diminish in size with the ascent of the stem, so when a certain stage of growth is reached, and as the plants arrive at the time of flowering, they cease to be produced altogether, but the stem continues to grow and produces leaves with prolonged midribs, affording a support to the plant and its inflorescence while maturing its seed. Sir Hugh Low observed of *N. ampullaria*, which he saw in Sarawak, that the first formed leaves have no blades but only pitchers, with which the ground is frequently covered as with a carpet."

Other habits of growth are no less interesting. Some of the Nepenthes keep to the ground, but most of them climb tall trees. The species are, with very few exceptions, all more or less epiphytal, and *N. Veitchii* is said to be wholly so. As they climb, the tips of the leaves take a turn or two around a nearby twig. Like all pitcher plants, Nepenthes are poorly supplied with roots, and as the plants grow above they are said to die away below. Thus their lowest point may be 20 feet above ground. However, they can send out new roots all along the stem and penetrate the thick covering of moss and lichen often found on the trunks of trees growing in hot, moist regions. As to size of pitchers the species vary greatly. The kinds first known to cultivation, as *N. gracilis*, *ampullaria* and *Phyllamphora*, have pitchers about as large as a man's thumb. Others, as *N. Northiana*, *Veitchii*, *Rafflesiana*, *bicalcarata* and *sanguinea*, may be 6–12 in. long or more. The great Rajah, which is a dwarf plant about 4 ft. high, with its pitchers resting on the ground in a circle, has been known to have pitchers holding 2 quarts, while in another was found a drowned rat. The fls. of a Nepenthes are produced in a pseudo-terminal fashion on old plants. The male and female fls. are borne on separate plants. They are green or purple, small, a hundred or so in a raceme or panicle, with 4 perianth segments. Ordinarily Nepenthes are not permitted to flower, the stems being stopped, partly for the sake of taking cuttings, but chiefly because the most and best pitchers are produced from the new growth of compact plants rather than from tall and straggling specimens.

"Of the 36 species, or thereabouts, known to science,' says Veitch, "14 are confined to Borneo, 3 more are common to that and adjacent islands, 13 more are extra-Bornean but strictly Malaysian, the remaining 6 are much scattered—there is one in North Australia, one in New Caledonia, one in Ceylon, one in the Seychelles, one in Madagascar and one in northeast India." The great majority of the species are found on equatorial islands at low elevations near the seacoast, in a climate of wonderfully uniform temperatures and a yearly rainfall of 70–80 in. As a general rule the greatest heat of the day does not exceed 90–92° F., while it seldom falls during the night below 74° F. The usual daily range is only 10° and the extreme 15°. During a large part of the year the air of the Nepenthes region is nearly saturated with moisture, so that a very slight fall of temperature produces copious dews and showers even at high temperatures and low altitudes.

The species which grow at high altitudes form a most remarkable and exceptional group. There are four of them, which grow only on Kina Balou, a mountain in Borneo, which is 13,700 feet high. These species are found at altitudes ranging from 5,000 to 10,000 feet, in the following order: *N. Lowii*, *Edwardsiana*, *Rajah* and *villosa*. These four are amongst the largest and most distinct of all Nepenthes. *N. Lowii* gapes at one like a sardonic pelican (see Fig. 1472). *N. Rajah* has pitchers of immense size and unique shape (Fig. 1472). *N. villosa* and *Edwardsiana* differ from all other species in their rim, which is cut up, as shown in Fig. 1472, into rather few large coarse disks instead of numerous fine, crowded rings. Some of the best collectors in the world have been sent after these treasures, and the history of the chase for them rivals the most romantic and exciting orchid hunts. Up to Sept., 1897, only the Rajah had been successfuly brought to our northern hothouses, where it remains an unwilling prisoner. The capture of the others should be one of the horticultural triumphs of the twentieth century. In the particular zone in which these four species grow there is a peculiar combination of cold and wetness in the air rising from the sea which meets the cold air decending from the peak. There is a constant state of "Scotch mist" associated with a temp. of 40–45° F. "When plants of these noble species are brought down to the hot plains they soon die off, and even if shipped safely in Wardian cases, they cannot withstand the heat of the sea voyage." The Rajah was introduced in the form of seeds.

To grow the Rajah may well be regarded as the summit of the gardener's skill. "It is terrestrial in yellow loam and decomposed granite, with its great basal pitchers resting and often buried in dead leaves, moss and other detritus or debris." *N. villosa* is also terrestrial; *N. Lowii* and *N. Edwardsiana* epiphytal. For the Rajah and its three companions Burbidge proposes a cold greenhouse surrounded by hot ones, so arranged that the warm moisture-laden air of the latter could be admitted to the former, thus imitating the cold moisture-saturated atmosphere of their native habitat. In such a house the Odontoglossums of the higher slopes of the Andes and many other difficult things should be able to thrive.

As a whole, Nepenthes is a difficult group to grow. Pitcher plants deserve a house of their own, and they often get it. Within the group, however, there are certain kinds which are relatively easy to cultivate. The hybrids, as a rule, are easier to grow than the species. Anyone who wishes to begin in a small way should start with *N. Mastersiana*, which is often said by connoisseurs to be the largest, best colored and most desirable of all Nepenthes. This fine hybrid is named after Dr. Maxwell T. Masters, editor of the Gardeners' Chronicle, who has done more to preserve careful records of Nepenthes hybrids than anyone else. Some of the points of a good hybrid are: It should be easy to propagate and easy to grow; every leaf should bear a pitcher; the pitcher should be large and highly colored, the reddest ones being the most attractive; the wings should be broad and copiously fringed; the plants should never be without some pitchers, and the perfect pitchers should last all summer at least, without browning at the top. All or nearly all these points are met in *N. Mastersiana*, pitchers of which have been known to last two years.

Among the species one of the most distinct types is *N. Rafflesiana*, which is remarkable for its high neck supporting the lid. A form of it, known as *N. Hookeriana*, is thought to be a parent of more hybrids than any other Nepenthes. The wide rim of *N. Veitchii* gives its pitchers a strong individuality and makes it a favorite for hybridizing. The four Kina Balou species are very distinct, but for most people impossible. *N. albo-marginata* and a supposed hybrid of it named *cincta* are remarkable for a white ring just below the rim. The rest are for the hobbyist.

The literature of Nepenthes is very extensive. The only botanical monograph is that by J. D. Hooker in DeCandolle's Prodromus 17:91–105 (1873). This is an account in Latin of 34 species, of which a dozen or so are cultivated. For the origin and development of the pitchers, see J. D. Hooker in Trans. Linn. Soc. 22:415–424 (1859). For the horticultural side, see Veitch and Burbidge in Jour. Roy. Hort. Soc. of London 21:226–262 (1897).

Nepenthes are fanciers' plants *par excellence*. The problems connected with their insectivorous habits are of perennial interest to scientists, students and the general public, but to the gardener the fascination of Nepenthes lies chiefly in their oddity and the difficulty of their culture. The feeling of curiosity soon yields to a sense of their beauty. America is too young to have made many contributions to fanciers' groups in general, but the hybrid Nepenthes raised in America by the late Mr. Taplin are so remarkable for their continued success on both sides of the water that they deserve separate notice.

W. M.

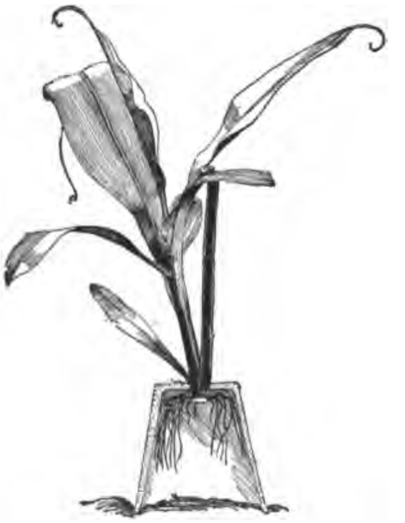
The Taplin Hybrids.—It is certainly true that my father's hybrids were superior to many of the European hybrids. He worked on them for many years, but left nothing whatever in the form of manuscript concerning them. He never wrote for publication, and the notes he made from time to time were distinctly hieroglyphic, and merely concerned the period of blooming of different kinds. He began his work in this line while at Chatsworth, but many varieties did not flower satisfactorily in England, or did not ripen viable seed. Consequently, he succeeded much beyond his expectations in this warmer climate. Most of his hybrids resulted from two varieties blooming at different times, and the undersigned has vivid recollections of an array of little thumb-pots, carefully lined and sealed with tinfoil, and kept in a dry place, which contained pollen saved from one period of blooming to another. He used *N. Phyllamphora*, *Hookeriana*, *distillatoria* and *Sedenii* quite largely. The majority of his hybrids were sold to B. S. Williams, of London, when the George Such collection at South Amboy was dispersed. *N. Taplini* is a very richly colored one. *N. Morganiæ*, *Outramiana*, *Williamsii* and *Lawrenceana* are his varieties, and the writer is fairly certain that *Courtii* is also, Court and Outram both being warm personal friends. Most of the plants were renamed when sent out in England.

EMILY TAPLIN ROYLE.

Nepenthes Culture at Washington, D. C.—Nepenthes are increased by cuttings and by seeds. The ripened shoots, with 4 or 5 leaves attached, make the best cuttings. They may be put in to root from December till the end of January, but under proper conditions the operation may be performed at any time during the year. Some of the free-rooting kinds, such as *N. Dominiana*, *N. lævis*, *N. gracilis*, *N. Phyllamphora* and *N. Mastersiana*, may be rooted in sand under a glass with a little moss tied around the base of each cutting. Under this treatment the temperature of the sand should be about 80° F. When the roots show through the moss they should be put in small pots and kept close for a couple of weeks. The most satisfactory method of propagation is to put the base of each cutting through the hole of an inverted 2-inch rose pot, plunging the pot in sphagnum moss in a temperature of from 80–90° F. See Fig. 1468. During the operation of rooting they must be kept in a close propagating frame and frequently syringed. See Fig. 1469. When the roots are about three-quarters of an inch long the cuttings should be potted, using a mixture of finely chopped fibrous peat, moss and sand, with a little finely broken charcoal added. They should be replaced in the moss and kept close until the pots are fairly well filled with roots and then gradually hardened off. All of the kinds do best suspended from the roof of a hothouse, the temperature of which should not fall below 65° F. in winter. The plants may be grown either in orchid pots or baskets.

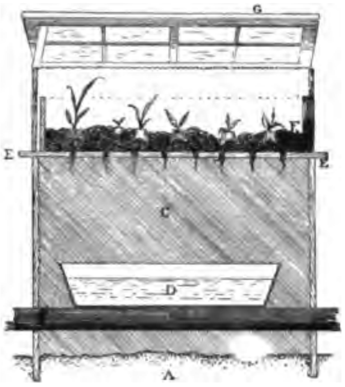
In potting or basketing plants from 4-in pots, large pieces of potsherd and charcoal should be firmly placed here and there among the potting material, which should consist of rough fibrous peat, moss and sand. The plants should not be allowed to grow as vines unless they are intended to produce seed. When large-sized pitchers are wanted the ends of the shoots should be nipped out after several leaves have been made and the pitchers are in the process of development; this throws strength into the last-formed leaves and produces very large pitchers. When the plants are in active growth they should be well drenched with water at least once each day and syringed frequently, but care should be taken not to overwater newly potted specimens. They should at all times be shaded from bright sunshine, and when a house is devoted to them, or partly occupied with plants requiring similar treatment, it should be shaded with cloth fixed to rollers. Well pitchered plants may be taken from the growing house and exhibited in good condition for a long time in a house under conditions which would be unfavorable for their growth. All of the hybrid forms are of easy culture. ***N. Mastersiana***, ***N. Dominiana***, ***N. Siebrechtii***, ***N. Outramiana*** and ***N. Henryana*** produce pitchers very freely. The species, as a rule, are not quite so free, but some of them thrive equally as well as the garden forms. ***N. Rajah***, ***N. Northiana***, ***N. sanguinea***, ***N. albo-marginata*** and ***N. bicalcarata*** are all more or less difficult to manage, as the conditions under which they grow in their native haunts are sometimes not easily imitated. ***N. ampullaria***, ***N. Rafflesiana***, ***N. Phyllamphora***, ***N. distillatoria***, ***N. lævis*** and ***N. Kennedyana*** are usually seen well furnished with pitchers. G. W. OLIVER.

Nepenthes Culture at New Rochelle, N. Y.—In propagating these charming plants the writer prefers cuttings of well-ripened wood, not too hard, and of 2 or 3 eyes in length. The lvs. are trimmed in one-half or more. The cuttings are placed in a close glass case, with a steady bottom heat of at least 80° or 85° in a bed of cocoa fiber or of sphagnum moss and sand mixed. The cuttings are always kept moist, and only enough air is allowed to reduce condensation.



1468. Good method of propagating Nepenthes.

The cutting is placed in an inverted pot. The stick at the right wedges the cutting and keeps it tight; it may also carry the label. The pot is cut in two vertically to show how the roots form in the air, without the aid of sand, water or even moss.



1469. A simple propagating frame.

Used by Robert Shore for propagating Nepenthes, Dracænas and other tropical subjects.

After they are rooted, which takes from two to three months, they are planted into shallow pans or orchid cribs in a mixture of fibrous peat and sphagnum moss, with perhaps some pieces of charcoal and crocks at the bottom. This material should be packed in firmly and tied down. Then set the plants again into bottom heat, in order to have them firmly established. Increase the air gradually until the plants are sturdy enough to be placed in the greenhouse, either upon a rack or suspended from the roof. The temperature where Nepenthes are grown should never be less than 60°, and it might be as high as 80° or 90°, providing plenty of moisture is given. Copious syringing, and during the summer months, dipping of the plants in water, is very beneficial. When the plants get too high, say above 18 in. or 2 ft., and their pitchers become smaller and smaller, as they grow taller, the best plan is to cut them back to within 4 or 5 eyes of the crown. Then the next growth of new leaves will give the very finest and best pitchers. When well established in their pans or cribs, and while in good growing condition, a light concoction of liquid manure is very beneficial. When the potting material is exhausted, it is essential that it be renewed at least once a year. Very fine plants can also be raised from seeds. When the plants are in bloom the miniature flowers should be carefully examined, to see that both sexes are represented, for if either sex be absent there can be no fertilization. The seed, when ripe, should be sown in pans in much the same material as was prescribed for cuttings, the pans placed in about the same sort of a place, and the material always kept moist. It takes from six weeks to two months to germinate the seed. After that, care must be taken that the young seedlings do not damp off. Once they are strong enough, with 2 or 3 leaflets, they can be pricked off and planted into other pans and fresh material, at the same time gradually accustomed to the air, and thus in from eighteen months to two years' time nice little plants may be had. In the experience of the writer the following kinds are more easily cult. than the others: ***N. Alleniana***, ***ampullaria*** and vars., ***bicalcarata***, ***Chelsoni***, ***Curtisii***, ***cylindrica***, ***distillatoria***, ***Dominiana***, ***Eyermanni***, ***hybrida***, var. ***maculata***, ***Hookeriana***, ***Hookeriana*** var. ***elongata***, ***lanata***, ***Lawrenciana***, ***Mastersiana*** (2 vars.), ***Morganiana***, ***Outramiana***, ***Patersonii***, ***picturata***, ***Rafflesiana***, var. ***insignis***, ***Savageana***, ***Sedeni***, ***Siebrechtii***, ***Stewartii***, ***Taplini***, ***Tildeniana***, ***Veitchii***, ***Zeylanica*** var. ***rubra***. H. A. SIEBRECHT.

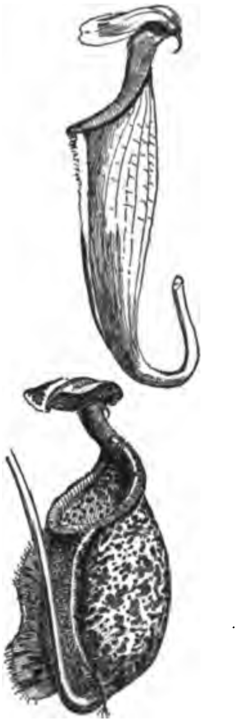
INDEX.

ampullaria, 7, 23.
atrosanguinea, 28.
bicalcarata, 1.
Burkei, 15.
Chelsoni, 25.
cincta, 18.
coccinea, 32.
Courtii, 31.
Curtisii, 21.
cylindrica, 10.
Dicksoniana, 29.
distillatoria, 12.
Dominii, 44.
Dormanniana, 35.
Edinensis, 26.
Eyermanni, 41.
gracilis, 19.
Henryana, 40.
Hookeriana, 27.
hybrida, 9, 45.
intermedia, 30.
Kennedyana, 5.
Khasiana, 14.
lævis, 11.
lanata, 6.
Lawrenciana, 37.
Madagascariensis, 2.
major, 7.
Mastersiana, 4.
mixta, 22.
Morganiana, 34.
Northiana, 20.
Northisii, 22.
Outramiana, 43.
Phyllamphora, 13.
Rafflesiana, 27.
Ratcliffiana, 42.
Rajah, 24.
rufescens, 8.
sanguinea, 3.
Sedeni, 36.
Stewartii, 39.
Stuartii, 39.
Veitchii, 6, 16.
villosa, 17.
vittata, 7.
Williamsii, 33.
Wrigleyana, 38.
Zeylanica, 8, 12.

A. *Color of pitcher wholly or chiefly red: no spots.*
  B. *Pitcher with 2 inward-pointing spurs*.......... 1. **bicalcarata**
  BB. *Pitcher without inward-pointing spurs.*
    C. *Shape of pitcher short-flask- or mug-shaped*.... 2. **Madagascariensis**
    CC. *Shape of pitcher quite cylindrical*.................. 3. **sanguinea**
    CCC. *Shape of pitcher cylindrical, but narrower above.*
      D. *Length of pitcher 7 in. or more* .... 4. **Mastersiana**
      DD. *Length of pitcher 5 in*...... 5. **Kennedyana**
AA. *Color of pitcher wholly or chiefly green: spots few if any.*
  B. *Wings always fringed.*
    C. *Foliage hairy beneath*..... 6. **lanata**
    CC. *Foliage not hairy beneath, unless along midrib.*
      D. *Lid smaller than the mouth, erect or bent back* .... 7. **ampullaria**
      DD. *Lid as large as the mouth.*
        E. *Upper part of pitcher flushed red: neck low*... 8. **rufescens**
        EE. *Upper part of pitcher green: neck high* .... 9. **hybrida**
        EEE. *Upper part of pitcher with a few red spots: neck rather high*..............10. **cylindrica**
  BB. *Wings not fringed (except sometimes N. lævis).*
    C. *Base of lid notched*........11. **lævis**
    CC. *Base of lid not notched.*
      D. *Inflorescence panicled*.....12. **distillatoria**
      DD. *Inflorescence racemose.*
        E. *Lvs. petioled*..............13. **Phyllamphora**
        EE. *Lvs. sessile* ....14. **Khasiana**
AAA. *Color of pitcher more or less spotted.*
  B. *Pitcher wingless*..........15. **Burkei**
  BB. *Pitcher winged.*
    C. *Foliage hairy beneath.*
      D. *Rim composed of many fine, close rings* ....16. **Veitchii**
      DD. *Rim composed of few coarse distant disks*............17. **villosa**
    CC. *Foliage not hairy beneath.*
      D. *Base of lvs. rather broad, the lvs. sessile or nearly so.*
        E. *Mouth of pitcher with a white margin below the rim* ....18. **cincta**
        EE. *Mouth of pitcher without a white margin.*
          F. *Back of pitcher 1-spurred*..19. **gracilis**
          FF. *Back of pitcher 2-spurred*..20. **Northiana**
      DD. *Base of lvs. narrowed into a petiole, which, however, is usually margined.*
        E. *Shape of pitcher like a tube, i.e., cylindrical, not constricted.*
          F. *Under side of lid 2-spurred*.21. **Curtisii**
          FF. *Under side of lid not spurred.*
            G. *Lid not bent back*.........22. **mixta**
            GG. *Lid bent back* .... { 23. **ampullaria, var. vittata**
        EE. *Shape of pitcher like a mug.*
          F. *Mouth of pitcher bigger than the bottom*................24. **Rajah**
          FF. *Mouth of pitcher smaller than the bottom.*
            G. *Wing fringes sparse*.......25. **Chelsoni**
            26. **Edinensis**
            GG. *Wing fringes copious*......27. **Rafflesiana**
        EEE. *Shape of pitcher like a flask, i.e., inflated below, more or less cylindrical above.*

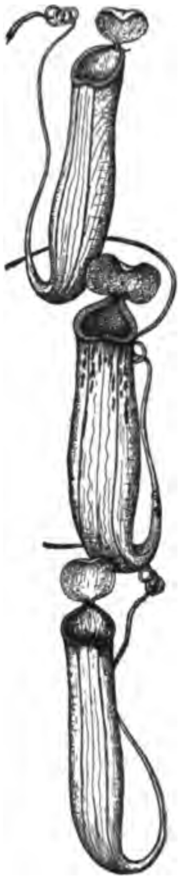
Nos. 28 to 45. FLASK-SHAPED AND SPOTTED PITCHER PLANTS, a key to which will be found on page 1073.

1. **bicalcaràta,** Hook. Young pitchers bowl-shaped, 3½ x 3 in.: old pitchers 8 x 6 in., including a neck 2 in. long: color of pitchers less vivid than in *N. sanguinea*. Borneo. I.H. 28:408. G.C. II. 13:201. Gn. 17:237; 33, p. 29.—The spurs resemble the fangs of a snake. Apparently no other species has such spurs. G. W. Oliver writes that all the specimens he has seen have been yellowish green, covered with rust-colored, downy material.



1470. How the pitchers change their shape.

The earliest and best are mug-shaped ones; the topmost pitchers of old and tall plants are cylindrical. *N. Rafflesiana*, both from same plant. Adapted from B. M. 4285.



1471. Three old-time Nepenthes.

Much confused in collections and difficult to distinguish: *N. Phyllamphora* above, *N. Khasiana* in the middle, *N. distillatoria* below.

2. **Madagascariénsis,** Poir. Lvs. leathery, reddish beneath, 5 x 1¼ in.: pitcher 4–6 in. long, crimson, flask-shaped; mouth nearly circular, with scarcely any neck. G.C. II. 16:685.

3. **sanguínea,** Lindl. Pitcher 12 x 2 in., quite cylindrical; no neck. Malaya. F.S. 22:2343. G.C. 1872:541; II. 11:13. F.M. 1874:128.—This is one of the very few species that has a sessile leaf.

4. **Mastersiàna,** Veitch (*N. sanguinea* x *N. Khasiána*). Pitcher 7 x 2 in., cylindrical, but the upper third narrower, deep claret red, sometimes with spots of darker red. G.C. II. 16:749; 21:249. I.H. 33:618. Gn. 23:390. Gng. 4:183.—This superb hybrid has the sessile leaf and red pitcher of *N. sanguinea*, with a form of pitcher intermediate between its two parents. There is a dark colored variety and a lighter colored one.

5. **Kennedyàna,** F. Muell. Pitcher 5 x 1⅓ in., reddish, cylindrical, but narrower above; lid as large as the mouth and nearly horizontal. Australia. G.C. II. 17:257.

6. **lanàta,** Masters. Here used for the plant with the green pitcher and yellow rim which is one of two things passing in the trade as *N. Veitchii.* The name *N. lanata* was first used at the bottom of plate 261, vol. 23 of I.H., but the accompanying text is headed *N. Veitchii,* and Masters declares that the text refers to *N. Veitchii* and not to the plant there figured. Masters gave, therefore, the first description of *N. lanata* in G. C. II. 17:178, but he fails to clearly distinguish the two plants. He says that *N. lanata* has blackish hairs on the under side of the lvs. and that the rim is "ultimately reddish brown." The typical *N. Veitchii* (B.M. 5080) is said to have "rufous" hairs on the under side of the lvs. Borneo. I.H. 23:261 (probably a poor picture). Gn. 17: 237 (as *N. Veitchii*). *N. lanata* should perhaps rank merely as a variety of *N. Veitchii.*

7. **ampullària,** Jack. This and Nos. 2 and 12 Hooker distinguishes from all other species by their inflorescence, which is more or less panicled, instead of racemose. Pitcher oblong, 3 in. long; lid smaller than the mouth, erect or bent back. Malaya. F.S. 22:2325 (copied from B. M. 5109 and reversed.—Var. **vittàta** is a spotted var. I.H. 24:272. Var. **màjor** also has been offered. Burbidge says this is the only kind that has no honey glands, but J. M. Macfarlane declares that all species have honey glands on the rim, though this species has none on the rudimentary lid.

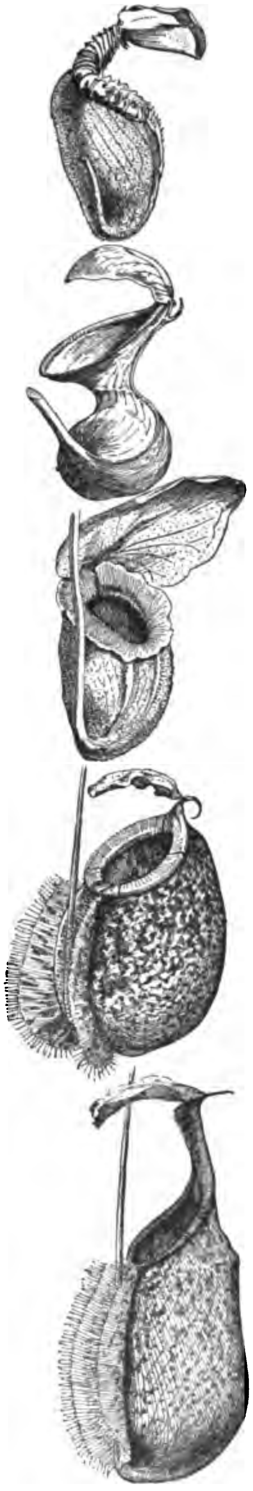
8. **rufèscens,** Veitch (*N. Zeylanica,* var. *rubra* x *N. Courtii*). Stem reddish, closely covered by broad decurrent leaf-stalks, which are about 1 in. long: lvs. 12 x 2½in.: pitcher narrowly flask-shaped, 7½ x 2 in. — Fresh pitcher sent by Siebrecht differs from G.C. III. 4: 669 in having a very narrow green rim, higher neck and lid faintly flushed red above but freely spotted below.

9. **hỳbrida,** Veitch. Lvs. 8–9 x 2: pitcher 5 in. long; mouth ovate; lid spotted; neck rather high. *N. Khasiana* was the male parent. Judging from the structure, J. M. Macfarlane thinks that *N. gracilis* was the female parent. Fully described in G. C. 1872:541.

10. **cylíndrica,** Veitch. Hybrid of *N. Zeylanica,* var. *rubra* x *N. Veitchii.* Pitcher 6–8 in. long, 1–1½ in. wide, pale green, with a very few crimson spots, inflated below, but perhaps not quite flask-shaped; lid oblong, much spotted at least beneath; rim is shown as narrow and regularly rolled back in G.C. III. 2:521, but said to be frilled and somewhat dilated toward the neck.

11. **lævis,** Lindl. Lvs. narrow, leathery, without pubescence, fringes or teeth: pitcher 2–4 in. long, cylindrical but narrower above; wings narrow-fringed or not; rim entirely without ribs (a unique character, if constant). Java, Singapore. G.C. 1848:655.

12. **distillatòria,** Linn. Fig. 1471. This is one of the oldest names among lovers of the pitcher plants, but Masters says the plants cultivated under this name are really *N. Khasiana.* *N. distillatoria* is one of very few species that has panicled fls. Lvs. narrowed into a broadly winged, half-clasping stalk, which is scarcely or not at all decurrent; texture leathery: pitcher 4–6 x 1–1½ in., cylindrical, obscurely dilated at the base, more or less flushed red upwards; lid about as large as the mouth and horizontal. Ceylon. P.M. 4:1. L.B.C. 11: 1017. Not B.M. 2798, which is *N. Khasiana.*



1472. Five distinct types of Nepenthes.

Beginning from the top they are: *N. villosa, Lowii, Rajah, Rafflesiana,* var. *Hookeriana* and *Rafflesiana.* The first three belong to the famous Kina Balou group. The fourth is the parent of more hybrids than any other kind.

N. Zeylanica, Rafin., is referred by Index Kewensis to *N. distillatoria.* *N. Zeylanica,* var. *rubra,* Hort., is an old garden name which Veitch in G.C. III, 2:521 refers to *N. hirsuta,* var. *glabrescens.* An abnormal form of *N. Zeylanica,* with 2 midribs and 2 pitchers from the same leaf, is shown in G. C. II, 13:309.

13. **Phyllámphora,** Willd. Fig. 1471. Lvs. with a long winged petiole, half-clasping or less; nerves numerous longitudinal; texture of young lvs. membranous: pitcher 4–6 in. long, subcylindrical; lid about as large as the mouth and horizontal. Cochin China, Moluccas.—The above description is from Hooker, not from B.M. 2629, which, according to H. J. Veitch (J. H. S. 21:232), is really *N. gracilis.* In R. H. 1887, p. 511, is a picture labelled *N. Phyllamphora,* which is the same thing as the one in R. H. 1861. p. 173, labelled *N. distillatoria.*

14. **Khasiàna,** Hook. Fig. 1471. Not advertised, but probably common in cult. under the name of *N. distillatoria.* Lvs. sessile, clasping, shortly decurrent; nerves pinnate; texture firm, but hardly leathery: pitcher 4–7 x 1½–3 in., spotted above, larger than those of *N. distillatoria.* Himalayas. B. M. 2798 (erroneously as *N. distillatoria*). In B.M. 2798 the pitcher is cylindrical but narrow at the bottom. J. M. Macfarlane verifies this description, and adds that the true *N. Khasiana* has a long, narrow pitcher which is green or tinged with brick red.

15. **Búrkei,** Mast. This is distinguished from apparently all other species by the absence of wings. It has the wide rim, with irregular fluted projections of *N. Veitchii.* Pitcher 8 x 2½ in., oblong, but swelled in the lower third. Borneo. G. C. III, 6:493. Var. **prolífica,** Mast., has a more slender habit, narrower lvs., smaller and less highly colored pitchers, produced in greater profusion.

16. **Vèitchii,** Hook. Fig. 1467. A splendid plant, remarkable for its extremely wide rim, which sometimes attains 2 in., and is often boldly scalloped at the margin instead of being rolled neatly back. Being one of the most distinct in general appearance, it has been much used in hybridizing. The name has been endlessly confused. It is commonly said that there are two forms of *N. Veitchii* passing in the trade—one with a spotted pitcher and red rim, and the other with a green pitcher and yellow rim. The latter is here called *N. lanata.* The former is indisputably the true *N. Veitchii,* since the original description of *N. Veitchii* consists in a mere citation of B. M. 5080, which, by the way, bears the erroneous legend of *N. villosa.* B.M. 5080, therefore, is the type of *N. Veitchii,* and that is a spotted pitcher with a red rim. *N. Veitchii* has a large hairy pitcher, attaining 10 x 3½ in., which tapers toward the base, is nowhere bulged, and has an ovate mouth, surrounded by a wide, high-necked rim; the lid seems small in comparison. Borneo. F. M. 1877: 265. G.C. II, 16:781. Perhaps, also, G.C. II, 18:809 (as *N. sanguinea*). Burbidge says that *N. Veitchii* is a true epiphyte, growing 20–100 ft. above ground and differing from most, if not all, other species in actually clasping the trunks and bearing its lvs. in a 2-ranked fashion.

17. **villòsa,** Hook. Fig. 1472. This is distinct from all other species here described by its rim, which is com-

posed of distant disks which are circular except for teeth which project down into the pitcher. *N. Edwardsiana* is probably the only other kind with such a rim. Borneo. Trans. Linn. Soc., plate 69, not B.M. 5080, which is *N. Veitchii.*—Not in cultivation anywhere as yet.

18. **cincta**, Mast. The leaf tapers to a broad dilated base, which is "intermediate between the sessile leaf of *N. Northiana* and the long tapering stalk of *N. albo-marginata:*" pitcher cylindrical, rounded at the base, 7–8 x 2½ in.; rim lobed, not entire as in *N. albo-marginata;* back of pitcher 2-spurred. Borneo. G. C. II. 21:576.—The white band is narrower than in *N. albo-marginata.*

19. **grácilis**, Korth. Lvs. sessile, long decurrent: pitcher cylindrical but inflated at the base and constricted at the middle, 2½–4 in. long. Borneo. B.M. 2629 (erroneously as *N. Phyllamphora*). V. 3:221 (poor as to shape of pitcher). Var. **màjor** is the only form offered.

20. **Northiàna**, Hook. Remarkable for its wide rim, which is said to attain 2 in. and is perhaps nearly as wide as in *N. Veitchii.* Pitcher flask-shaped, 12–16 x 3½–5 in. Borneo. Gn. 23, p. 496. R.B. 21, p. 271. S.H. 1, p. 107 (all the same cut). G.C. II. 16:717 is misleading as to width of rim, and was perhaps done from a very young pitcher.

21. **Cúrtisii**, Hook. This species is very distinct by reason of the shape of the pitcher. Pitcher 7 x 1½ in., as nearly cylindrical as in any species of the genus. The mouth and neck are like *N. Rafflesiana*, but the pitcher is not bulged below and the fls. are green instead of dark red. This species is unique by reason of its spurs. The back spur is borne not at the junction of back and lid as usual, but on the back of the pitcher. Moreover, the midrib of the lower surface of the lid is produced into 2 spurs—one near the base and a longer one near the apex. Borneo. B.M. 7138. G.C. III. 2:689. I.H. 35, p. 59 (same cut). G.C. III. 6:661.—A fresh pitcher sent by Siebrecht shows that this is even more distinct and splendid than the pictures show.

22. **mixta**, Mast. (*N. Northisii*, Veitch). Hybrid of *N. Northiana* and *N. Curtisii*, having the cylindrical pitcher of the latter but not the 2 spurs on the lower side of the lid. The lvs. are remarkable in being somewhat notched at the apex of the blade. Pitcher 8 in. long; rim deep crimson. G.C. III. 13:47. G.M. 36:754. R.B. 21, p. 268. —According to Veitch, the fls. are panicled.

23. **ampullària**, var. **vittàta**. Here may be sought the spotted var. of *N. ampullaria* described at No. 7. In I.H. 24:272 this spotted var. is represented with a small, broadly oblong, unconstricted pitcher and a lid bent back to a wholly exceptional degree.

24. **Rájah**, Hook. Fig. 1472. Distinguished by the immense size of the pitchers, their odd shape, the great mouth, the disproportionately large lid, and also by the tendril which is given off, not from the apex of the leaf, as usual, but from the under surface a short distance below the apex. Pitchers a foot or more long and three-fourths as wide. Borneo. G.C. II. 16:493. Gn. 22, p. 122. F. 1883, p. 157.

25. **Chélsoni**, Veitch (*N. Dominii* x *N. Rafflesiana*). Pitcher 3–4 x 2½ in. More fully described in G.C. 1872:542.

26. **Edinénsis** (*N. Rafflesiana* x *Chelsoni*). Raised at the Botanic Gardens of Edinburgh, but not described so far as known. A.F. 7:381.—Cult. at U. S. Botanical Gardens, Washington, D. C.

27. **Rafflesiàna**, Jack. Fig. 1470. This is one of the most distinct species by reason of its high-necked pitchers and purple fls. The young pitchers are mug-shaped (excluding the neck), while the mature ones (rarely seen in cult.) are actually wider at top than at bottom and taper gradually to the base without any sudden constriction. Stem green and glabrous: young pitchers often 5½ x 3 in.; old ones sometimes 7 x 2 in. India. B.M. 4285 (copied and reversed in F.S. 3:213). F.S. 16:1698; 22:2343. F. 1850:77; 1872, p. 221. G.C. III. 12:553; 1872:541. R.H. 1869, p. 130 (as *N. Raflesea*). Var. **insignis**, Mast., is a more robust plant: stems covered when young with white chaffy scales: pitchers mug-shaped. 9 x 4 in., thickly beset with small, brownish, stelliform hairs. G.C. II. 8:425. Var. **nivea** is densely covered with white down. Var. **pállida** is cult. at Washington, D. C. Var. **Hookeriàna** (*N. Hookeriàna*, Low. *N. Hoòkeri*, Alphand). Fig. 1472. Said to be the parent of more hybrids than any other kind. It seems to be a distinct botanical variety from Borneo, differing essentially in having a low neck. According to Masters (G.C. II. 16:812), it also differs in having a short petiole which is very broad at the base, and a flatter, not hood-like lid. Also the lvs. are thicker, with 3–5 secondary nerves on each side of the midrib and parallel to it, the tertiary transverse nerves much more closely arranged than in *N. Rafflesiana*. The figure in G.C. II. 16:813 (repeated in G.C. III. 12:557, I.H. 41, p. 145, and S.H. 1:57) is inaccurate as to the spur, which is distinctly shown as a prolongation of the rim, rather than of the lid or the midrib of the back. See A.G. 18:877. Also Alphand's Promenades de Paris, last colored plate of the volume of plates.

FLASK-SHAPED AND SPOTTED PITCHER PLANTS.

(The key continued from page 1071.)

This group (Nos. 28 to 45) is composed wholly of hybrids, and the blood of *N. Rafflesiana* enters largely into them. The high-necked kinds are more like typical *N. Rafflesiana*, while the low-necked kinds resemble *N. Rafflesiana*, var. *Hookeriana*. All of these hybrids seem to be more flask-shaped than *N. Rafflesiana*, i. e., they are proportionately longer, and more constricted above.

F. *Neck extremely high, associated with a very oblique mouth, as in Fig. 1472 (bottom).*
G. *Spots red and yellow: pitchers chiefly red* .... 28. **atrosanguinea**
GG. *Spots red and green.*
H. *Rim wide, 1 in. or so* .... 29. **Dicksoniana**
HH. *Rim narrow.*
I. *Wings wavy and fluted (as well as fringed)* .... 30. **intermedia**
II. *Wings not wavy* .... 31. **Courtii**
FF. *Neck shorter: mouth less oblique. See Fig. 1472 (next above bottom).*
G. *Spots red and yellow, hardly green.*
H. *Rim parti-colored* .... 32. **coccinea**
33. **Williamsii**
HH. *Rim self-colored, dark* .... 34. **Morganiana**
GG. *Spots red and green.*
H. *Wings wavy (as well as fringed)* 35. **Dormanniana**
HH. *Wings not wavy.*
I. *Shape of lid roundish rather than oblong.*
J. *Base of lid heart-shaped, i. e., notched* .... 36. **Sedeni**
JJ. *Base of lid not notched.*
K. *Rim green* .... 37. **Lawrenciana**
38. **Wrigleyana**
KK. *Rim dark red or parti-colored.* 39. **Stewartii**
40. **Henryana**
41. **Eyermanni**
42. **Ratcliffiana**
II. *Shape of lid oblong* .... 43. **Outramiana**
44. **Dominii**
45. **hybrida, var. maculata**

28. **atrosanguinea**, Hort. American hybrid, said to resemble *N. Sedeni* and *N. rubra*. Said to be much richer in color than *N. sanguinea*. Pitcher 6 x 2½ in.; rim red and blackish. G.C. II. 17:827.

29. **Dicksoniàna**, Masters (*N. Rafflesiana* x *Veitchii*). This has a rim almost as big as that of *N. Veitchii*, but not so flat. Pitcher 10 x 3½ in.: lvs. with 3 parallel nerves between midrib and margin. G.C. III. 4:541.

30. **intermèdia**, Veitch (*N. Rafflesiana* x ?). Stem covered with pale rust-colored down: lvs. taper to both ends: pitcher 6 x 2½ in.; rim flattish, parti-colored; lid less hooded than in *N. Rafflesiana*. G. C. II. 17:179; III. 12:125. F. 1875, p. 257 (neck too low).

31. **Cóurtii**, Veitch (*N.* ? x *Dominii*). Stem purplish and hairy: pitcher 5 x 2¼ in., of very firm texture. G.C. III. 6:845.

32. **coccinea,** Mast. American hybrid of unknown parentage. Pitcher 6 x 3 in., crimson, slightly speckled with yellow; rim red and black; lid spotted. G.C. II. 18:169. I. H. 41, p. 143.—Cannot be distinguished by original descriptions and pictures from the next. The leaf-margins of both have numerous, regularly disposed, minute teeth.

33. **Williamsii,** B. S. Williams (*N. Sedeni* × *N. Hookeri*). Pitcher 4–5 in. long, intermediate in shape between its parents; interior spotted red; lid reddish brown beneath. G.C. II. 14:40.—In Gn. 27:494 the rim is erroneously shown as dark and self-colored, but a fresh pitcher sent by Siebrecht has a beautiful, shiny, richly parti-colored rim.

34. **Morganiàna,** Hort. (*N. Mórganiæ*, Hort.). One of Taplin's American hybrids, supposedly between *N. Hookeri* and *N. Phyllamphora*. Lvs. reddish, margins entire: pitcher medium-sized. Originally said to have a green lid, but in Gn. 23:390 the lid is light yellow, spotted red, at least below.

35. **Dormanniàna,** Masters. Possibly an American hybrid; parentage unknown. Lvs. finely ciliate at the edges: pitcher 6 x 3; lid spotted. G. C. II. 17:525.—Fresh pitcher sent by Siebrecht has a parti-colored rim.

36. **Sèdeni,** Veitch. Masters, in his careful description in G.C. 1872:542, says that the lid is cordate, but this feature is not shown in the Veitchian trade cut used in F. 1872, p. 54 and S. H. 1:104. Stem terete, glabrous: lvs. 7 x 1¾ in.: pitcher (probably not mature) 3 x 1 in

37. **Lawrenciàna,** B. S. Williams (*N. Sedeni* × *Hookerii*). Pitcher 4–5 in. long, intermediate in shape between its parents, and in 1880 said to be a brighter red than any kind except *N. sanguinea*. Lvs. slightly serrate: lid reddish beneath. G. C. II. 14:40. I. H. 29:460 (lid spotted above).

38. **Wrigleyàna,** Hort. Said to be another hybrid of *N. Phyllamphora* and *N. Hookeri*. Lvs. light green, like those of *N. Phyllamphora*, 10–12 x 1¾–2 in., acute at both ends, glandular beneath, and with 2 or more parallel nerves on each side of the midrib. G. C. II. 17:143.

39. **Stéwartii,** Veitch (*N. Stùartii*, Hort.?). Same parentage as *N. Morganiana*. Lvs. said to have the light green color of *N. Phyllamphora*, with the leathery texture of *N. Hookeri*. Pitcher intermediate in size. F. 1879, p. 157, where the pitcher is said to have a "prominent rib" on the back. Specimens cult. at Cornell Univ. have parti-colored rims.

40. **Henryàna,** B. S. Williams (*N. Hookeri* × *N. Sedeni*). Pitcher 5 x 2. I.H. 29:460. Gn. 27:494. Here may belong I.H. 34:15, but the pitchers are larger and redder except on the lid, which is nearly green and unspotted, the rim decidedly parti-colored and the wings entirely unfringed, the last point being the most suspicious.

41. **Éyermanni,** Hort. Lvs. 10 x 2 in., dark green, leathery, with a few minute teeth on the margin: pitcher 4 x 1½ in., handsome dark red, with relatively few green spots; mouth ovate, rather short-necked; lid roundish, as large as the mouth, freely spotted above, scarcely beneath; rim narrow, slightly parti-colored; wings in the specimen sent with a short fringe above and none below. Described from fresh pitcher furnished by Siebrecht.

42. **Ratcliffiàna,** Veitch (*N. Phyllamphora* × *N. Hookeri*). Lvs. light green, leathery, 12–15 x 1½ in.: pitcher 5–6 x 2 in.; rim parti-colored; lid about as large as the mouth, ovate, glandular and spotted below. G.C. II. 17:178.

43. **Outramiàna,** B. S. Williams (*N. Sedeni* × *N. Hookeri*). Pitcher 5 in. long; interior well spotted; rim parti-colored; lid spotted, at least below. G.C. II. 14:41. F. 1880, p. 156 (same cut). F.M. 1879:384.

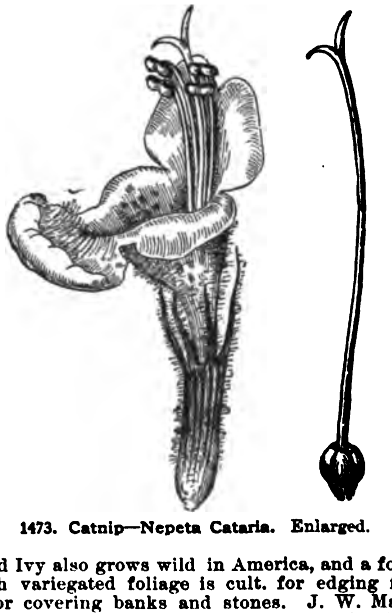
44. **Domínii,** Veitch (*N. Domíniana*, Hort.? *N. Rafflesiàna* ×?). Stem purplish, slightly downy: lvs. 16–18 x 3 in., 1-nerved: pitcher 6 x 2 in., lid spotted.—Siebrecht sends a small pitcher with a high neck, narrow, parti-colored rim, lid faintly flushed above, freely spotted below. There is more green than red in the pitcher.

45. **hỳbrida,** var. **maculàta,** Hort. (*N. Khasiana* ×?). Stem glabrous: lvs. 13 x 2¼ in., 1-nerved: pitcher 5 x 1½ in., cylindric, but slightly contracted above the middle. The color of the lid is not recorded. J. M. Macfarlane thinks that *N. gracilis* was the other parent.

The following kinds have been offered in America but cannot at present be distinguished from those given above: *N. Alleniàna*, Hort. Siebrecht.—*N. amábilis*. Hort. Said to be a hybrid between N. Hookeri and N. Rafflesiana; int. 1886.—*N. Amesiàna*, Hort. Said to be a hybrid between N. Rafflesiana and N. Hookeriana; int. 1893.—*N. Clàytonii*, offered 1895 by Pitcher and Manda.—*N. compácta*. Hort., is figured in Gn. 27, p. 497, but can hardly be distinguished bv the figure from any other spotted, flask-shaped, low-necked kind.—*N. Craigiàna*, Hort. Siebrecht.—*N. Edmundsii*, Hort. Pitcher and Manda.—*N. Elmenhorstiàna*, Hort. Siebrecht.—*N. excélsior*, Hort. Hybrid of Rafflesiana and N. Hookeriana. Pitcher 9 in. long, spotted, oblong, rounded at base.—*N. Findleyàna*, Hort. A hybrid with medium-sized spotted pitchers: int. 1886.—*N. Hamiltoniàna* is said to be the same as N. coccinea.—*N. Hibberdii* is probably the correct name of the hybrid advertised by Pitcher & Manda as N. Hilberdii. Pitcher spotted; lid green above, indistinctly marked with red below; 1883.—*N. Jóhnsonii*, Hort. Siebrecht.—*N. Lànewoodii* or *N. Lònewoodii*, Hort. Siebrecht.—*N. Màyi*. Hort. Siebrecht.—*N. Osborneàna*, Hort. Pitcher & Manda.—*N. Paradìsæ*. Hybrid, 1883. Pitcher spotted, much narrowed near center, 4–5 x 2–2½; rim green; lid green above, reddish beneath.—*N. Pátersonii*, Hort. Saul. Spotted. Pitcher cylindrical but narrower above.—*N. picturàta*, Hort., is figured in Siebrecht's catalogue with an oblong pitcher, which is slightly wider below but not flask-shaped.—*N. Pítcherii*, Pitcher & Manda. Hybrid between N. Paradisæ and N. Henryana. Pitcher deep pink; 1895.—*N. Rœblingii*, Pitcher & Manda, 1895. Pitcher almost globular, medium-sized, spotted.—*N. Savageàna*, Siebrecht, has mug-shaped, spotted pitchers.—*N. Seèmannii*. Hort. Pitcher & Manda.—*N. Siebrechtiàna* is said to have immense pitchers, resembling N. Amesiana but lighter colored and dented on one side.—*N. Sèabrightii* of Saul's catalogue is probably the same thing as the preceding, though Saul says it is in the style of N. Rafflesiana.—*N. spléndida*, Hort. Pitcher & Manda.—*N. supérba*, Hort. Hybrid having the habit of N. Hookeriana and pitcher intermediate between N. Hookeriana and N. Sedeni. F.M. 1881:434.—*N. Táplini*, Hort. Siebrecht.—*N. Thorpéiana*. Hort. Siebrecht.—*N. Tíldenii*, or *Tíldendiàna*, Hort. Pitcher & Manda.—*N. Wádleyana*, Hort. Siebrecht, a flask-shaped pitcher which is much redder above.

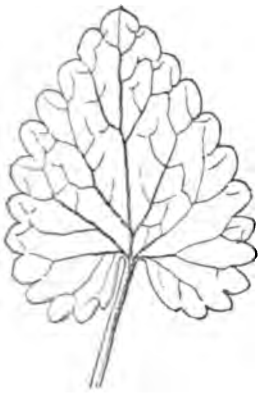
W. M.

NÉPETA (Latin, perhaps from Nepete, an Etrurian city). *Labiàtæ*. This genus includes Catnip, Ground Ivy and some other hardy perennial herbs of the easiest culture. Catnip is a familiar weed near dwellings and barns. Cats are fond of it, and Catnip tea is a pungent memory with those who have survived the era of homely simples. The seeds of Catnip are still offered.



1473. Catnip—Nepeta Cataria. Enlarged.

Ground Ivy also grows wild in America, and a form of it with variegated foliage is cult. for edging flower-beds or covering banks and stones. J. W. Manning writes that it is hardy in light, well-drained soils, but sometimes winter-kills in moist soils. It is also used in vases and baskets. Nepeta is a genus of about 120 species, mostly in the northern hemisphere outside the tropics. Perennial or annual herbs, tall and erect, or dwarf and more or less trailing: lvs. dentate or incised, the floral ones like the rest or reduced to bracts: whorls of fls. crowded in a dense spike, or in a loose cyme, rarely few-fld. and axillary: fls. blue or white; calyx 15-nerved; corolla 2-lipped; perfect stamens 4: ovary 4-parted. The genus is placed between Lopanthus and Dracocephalum, and is characterized as follows: calyx tubular, the mouth straight or oblique, 5-toothed; stamens usually parallel, ascending; anther cells divergent or divaricate. See Fig. 1473.



1474. Leaf of Catnip.

Nepeta Glechoma is a perennial creeping plant of easy culture in any loose, rich, fairly moist soil, in either shade or full sunlight, but to be luxuriant in the open it should have a moist soil. It is a very rapid grower, and is therefore often troublesome when planted with other low-growing plants. It is useful as a ground covering in shrubbery borders and shady places generally.

A. *Blooms small, inconspicuous.*

B. *Color of fls. white or nearly so.*

Catària, Linn. CATNIP or CATNEP. CATMINT. Figs. 1473, 1474. Tall and erect: lvs. heart-shaped, green above, whitish below, crenate, stalked. Eu., Orient.

BB. *Color of fls. blue.*

Glechòma, Benth. GROUND IVY. GILL-OVER-THE-GROUND. Makes a dense mat: lvs. roundish, more deeply notched at the base than Catnip, and green on both sides, the floral ones like the others, not reduced to bracts as in the other kinds here described: whorls axillary, few-fld. Nat. from Eu., Asia. B.B. 3:87.—The green-lvd. form is less cult. than var. **variegata** (*N. hederàcea*, Trev., var. *variegàta*, Hort.).

AA. *Blossoms larger, showy, blue.*

B. *Lvs. not notched at the base.*

macrántha, Fisch. Erect, branching, nearly glabrous: lvs. short-stalked, ovate-lanceolate, green on both sides: cymes peduncled, few-fld.: fls. 1 inch long; bracts minute. Altai. B.M. 2185 (*Dracocephalum Sibiricum*).

BB. *Lvs. notched at base.*

C. *Fls. pedicelled.*

betonicæfòlia, C. A. Mey. Upper lvs. green on both sides: bracts a half shorter than the calyx. Caucasus.

CC. *Fls. sessile.*

Mussini, Spreng. Diffuse; branches ascending: lvs. green above, whitish below: racemes unbranched: bracts much shorter than the calyx. Caucasus, Persia. R.H. 1891:300. B.M. 923 (*N. longifolia*).—Not adv.

F. W. BARCLAY and W. M.

NEPHÈLIUM (old name of the burdock applied to this genus because the rough fruits were supposed to resemble those of burdock). *Sapindàceæ.* The Litchi nut can be obtained in the dried state in the larger markets of the eastern states and is often seen on the tables of trans-Pacific steamers. The tree is cult. in the West Indies but not in the U. S., unless in Porto Rico. The whole fruit is about as large as a small walnut. The outer covering consists of a thin, brittle shell, under which is a layer of soft, aromatic and delicious pulp; finally in the center is a rather large, smooth, hard-shelled seed, from which the pulp readily separates. It is one of the most delicately flavored fruits that the tropics produce. In dried state it will keep a long time, and can be transported to distant parts. Thus dried, the pulp shrinks from the shell and becomes tough and less aromatic and delicate.

The tree is a native of southern China and the Malay archipelago, where it has been cult. for at least 1,500 years. It has been brought to the extreme south of Japan and to various tropical countries. It was introduced to southern Fla. in 1886. Only a limited area is suited to its growth, as it does not readily adapt itself to climates which differ much from that peculiar to its original habitat. It is a good-sized tree, said to attain a diameter of 2–3 ft. It is probably cult. under glass in a few European botanic gardens for its economic interest.

The preceding account is abstracted chiefly from G. C. Georgeson's article in A.G. 12:269. W. A. Taylor writes: "The Litchi nut is also sold in Chinese stores in the larger cities in the form of preserves packed in syrup in glass jars. In this form the peculiar fragrance and flavor of the fresh fruit are well preserved."

1475. Litchi Nut—Nephelium (×½).

Nephelium is a genus of about 20 species of oriental trees: lvs. alternate, abruptly pinnate; lfts. not quite opposite, oblong, entire, rarely serrate: panicles axillary and terminal, many-fld.: fls. small, regular, polygamo-diœcious; calyx small, cup-shaped, 4–6-cut; petals none or 4–6, villous or with 2 scales; stamens 6–10: ovary 2–3-lobed. Botanically the genus is allied to the soap-berry.

Litchi, Cambes. LITCHI or LEECHEE. Fig. 1475. Lfts. about 3 pairs, lanceolate, 1-nerved beneath. China. A. G. 12:269.

NEPHRÒDIUM. A name used at Kew for species of Dryopteris, which see. *N. emersum*, var. *cristatum* is advertised, but unknown to botanists.

L. M. UNDERWOOD.

NEPHRÓLEPIS (Greek, *kidney scale;* alluding to the indusia). *Polypodiàceæ.* A genus of subtropical ferns with pinnate lvs., the pinnæ articulated to the rachis, free veins and a reniform or roundish indusium rising from the apex of the upper branch of a vein. See *Fern.*

INDEX.

acuta, 3.
Bausei, 3.
Bostoniensis, 2.
cordata, 1.
cordifolia, 1.
davallioides, 4.
Duffii, 1.
exaltata, 2.
furcans, 4.
Paradisæ, 2.
pectinata, 1.
Philippensis, 2.
plumosa, 2.
rufescens, 3.
tripinnatifida, 3.
tuberosa, 1.
Washingtonensis, 2.

A. *Rootstocks bearing tubers.*

1. **cordifòlia**, Presl. (*N. tuberòsa*, Hook.). Stalks 1–4 in. long: lvs. 1–2 ft. long, 1½–2 in. wide, with close, often imbricated pinnæ, usually blunt at the apex. Mexico to Japan and New Zealand. *N. pectinata*, Schott, is a form with auricled lvs. and no tubers. *N. Duffii*, Moore, is apparently a monstrous form from New Zealand, with tufted habit and branching fronds. *N. cordata compacta*, Hort., is said to be a var. of *N. cordifolia*.

AA. *Rootstocks without tubers.*

B. *Margins entire or crenulate.*

2. **exaltàta**, Schott. SWORD FERN. Stalks 4–6 in. long: lvs. 1–2 ft. or more long, 3–6 in. broad; pinnæ close, usually acute, the edge entire or slightly crenate, the upper side auricled. Fla. to Brazil, Hong Kong and East Africa. The "Boston Fern," or var. *Bostoniensis* (see Plate XI) of the horticulturists, is highly valued but has no standing as a botanical variety. It is sometimes in the trade under the horticultural name *N. Paradisæ*. *N. exaltata*, var. *plumosa*, Hort., has double, overlapping crests. *N. Philippensis*, Hort., with dark-lvd., dark green foliage, probably belongs here. *N. Washingtoniensis* and *N. Washingtoniensis*, var. *pendula*, Hort., are said to be forms of this species. G. W. Oliver says that their fronds last well after being cut.

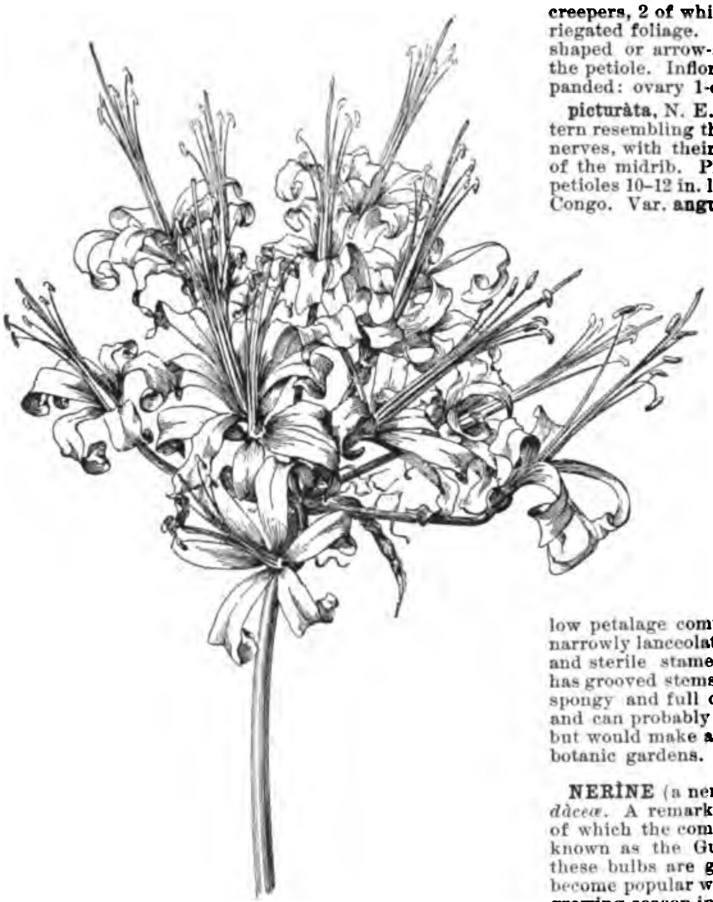
3. **acùta,** Presl. (*N. Baùsei*, Hort.). Lvs. 2–4 ft. long, 8–12 in. wide, on short slightly scaly stalks; pinnæ ½–1 in. wide, acute, with entire or slightly crenate margins, the lower basal angle rounded, the upper auricled: indusia suborbicular. Fla. to Brazil and in the tropics of the Old World.—*N. rufèscens*, Presl., is a woolly variety. *N. tripinnatifida* is said to be a variety of this species.

BB. *Margins pinnatifid.*

4. **davallioides,** Kunze. Lvs. drooping, 2–3 ft. long, 1 ft. or more wide; lower pinnæ inciso-crenate, the upper narrower, with deeper lobes. In cultivation the pinnæ are forked often several times and are sometimes irregularly crested; their form resembles the horticultural variety **fúrcans.** Java.—Var. **fúrcans múlticeps** is also advertised.

N. serrulàta cristata, once advertised by John Saul, seems unknown to the botanies.—*N. Wittboldii*, F.R. 5:247 (1900); 6:525, is a variety of Boston Fern with fronds thrice as wide as the type. The pinnæ are said to have characteristic convolutions.

L. M. UNDERWOOD.



1476. Nerine curvifolia, var. Fothergilli (× ⅜).

The Boston Fern, *Nephrolepis exaltata*, var *Bostoniensis*, is without doubt the most valuable ornamental foliage plant for house and conservatory decoration that the trade has put on the American market for years. Its many good points made it a welcome addition to our list of plants, and the flower-loving public soon discovered that it was a fit companion for the palms, enduring with them equally well the dry atmosphere of the house. Thriving under indifferent care, it has proved itself a very valuable plant. It grows where many of our best house plants had been failures. It is a plant that can be procured at little cost and is easily grown. It is propagated by division or by the creeping rhizomes. This is best done in early spring. The rhizomes may be pegged down in small pots and when well rooted may be detached from the parent plant. A good compost for potting consists of soil and leaf-mold, with some well-rotted manure added. Shift into larger pots or pans as the plants require. Secure good drainage and give plenty of water, especially during the summer months. This treatment will make specimen plants of 3–5 ft. in diameter by October, with graceful fronds drooping in such a manner as to hide the pot or pan. A well-grown specimen suspended in a bay-window is a sight long to be remembered. There are many plants in good condition that have been in use for several years during the summer on the veranda and in the house during the winter months.

JAMES DEAN.

NEPHTHŸTIS (name borrowed from Egyptian mythology; Nephthys, mother of Amibis, wife of Typhon). *Aràceæ*. About half a dozen species of tropical African creepers, 2 of which are cult. in hothouses for their variegated foliage. The lvs. are all more or less halberd-shaped or arrow-shaped, with scarcely any sheath on the petiole. Inflorescence terminal: spathe concave-expanded: ovary 1-celled; ovule solitary, pendulous.

picturàta, N. E. Br. The white markings form a pattern resembling the tips of fern fronds laid between the nerves, with their points all directed towards the base of the midrib. Plant stemless, spreading by runners: petioles 10–12 in. long: blade 6–12 in. long, 5–9 in. broad. Congo. Var. **angustàta,** N. E. Br., has smaller and narrower lvs. Figured in catalogue of U. S. nurseries 1895.

triphỳlla, Hort. "A pretty stove creeper with dark green thrice-divided lvs. marked with greenish white in the exact shape of the leaf."

NEPTÙNIA plèna is a rare sensitive plant of aquatic habit found in the East and West Indies and S. Amer. It has foliage much like that of the common sensitive plant, *Mimosa pudica*. The fls. are so odd that no one at first sight would imagine that they belong to the legume family. They are more or less egg-shaped in outline, 1¼ x 1 in., and borne singly on stalks 6 in. long. They are drooping and have numerous stamens. The singular feature of these fls. is a mass of yellow petalage composed of 6 or more tiers of reflexed, narrowly lanceolate strips, which are really transformed and sterile stamens. The plant floats on the water and has grooved stems, the portion under water being white, spongy and full of air-cells. It is of difficult culture and can probably not be secured in Europe at present, but would make an interesting addition to our northern botanic gardens. B.M. 4695.

NERÌNE (a nereid of Greek mythology). *Amaryllidàceæ*. A remarkable genus of tender bulbous plants, of which the commonest species is *N. Sarniensis*, long known as the Guernsey Lily from the island where these bulbs are grown to perfection. They will never become popular with florists, because the winter is their growing season instead of flowering time. They belong to the very small class of autumn-blooming bulbs. The common kinds flower from Sept. to Nov. without any foliage, and the lvs. are developed all winter. About May the lvs. die down and the bulbs rest from May to Aug. The fls. range from scarlet through salmon and pink shades to white, and are borne in umbels of 4–20 fls., on scapes varying from 1–3 ft. long and averaging 1½ ft. The fls. are 6-parted, the segments more or less rolled back and sometimes crimped or fluted.

There are 10 species, all from South Africa. A common trade name is *Nerine Japonica*, which is really a Lycoris since it has black seeds, while all the true Nerines have green seeds. It, however, has the autumn-blooming habit and fls. of the same general appearance as true Nerine. Nerines have two distinct types of beauty, illustrated by Figs. 1476 and 1477. The kinds with the narrow perianth segments, which are crisped or fluted, have a spidery look and are not as popular as the kinds with broad, flat segments, which make a showier cluster of fls. The segments vary from one-twelfth to one-half an inch in width. The showiest kinds are hybrids or varieties of *N. Sarniensis* and *N. curvifolia*, the former species being the most prolific of varieties. In these two species the strong, vertical lines of the erect, long-protruded stamens make a striking feature. The fls. of the other species have more of a drooping tendency and the stamens are shorter and declinate, as in Fig. 1477. *N. pudica* is perhaps the choicest white-fld. kind. Nerines have bulbs 1–2 in. or less in diam., and about 6 lvs., varying from 8–18 in. in length and 4–9 lines in width. Among the uncultivated kinds are some with short, stout scapes and others with appendages at the base of the filaments. The lvs. appear after the fls. in the first two species, but with the fls. in the others. Baker, Handbook of the Amaryllideæ, 1888, and Flora Capensis, vol. 6, 1896–7.

The following American experience is condensed from an article by the late John Robertson, in the Florists' Review 1:675.

Nerines are noted for the sparkling texture of their fls. In strong light they have the appearance of being frosted over. No flower with which the writer is acquainted appears to better advantage under artificial light than *N. Fothergilli*, var. *major*.

The secret of success with Nerines is to secure the fullest possible development of the bulbs. This refers to their winter treatment. They enjoy abundance of water at the root and overhead, with occasional applications of liquid manure. This treatment should never cease until the lvs. turn yellow, which is a sign that the plants are finishing their growth. Then diminish the water supply gradually, lay the pots on their sides where they are not likely to get wet, and in full sunlight, so that the bulbs may ripen thoroughly.

Nerines do not like to have their roots disturbed, nor do they require much root room: they grow and flower best when hard pot-bound. Three bulbs planted in good fibrous loam with a little sand may remain in a 5-inch pot for five or six years, or even longer, as the offsets can be rubbed off and separately potted while the parent bulbs go on increasing in size. Each year as the flower-scape appears pick off about an inch of the surface soil with a sharp-pointed stick, and give the ball of roots a good soaking and a slight top-dressing.

INDEX.

Amaryllis, 1, 2, 5, 6.
carnosa, 1.
corusca, 1.
curvifolia, 2.
flexuosa, 3.
Fothergilli, 2.
humilis, 6.
insignis, 1.
Manselli, 3.
Plantii, 1.
pudica, 4.
pulchella, 3.
rosea, 1.
Sarniensis, 1.
splendens, 6.
undulata, 5.
venusta, 1.

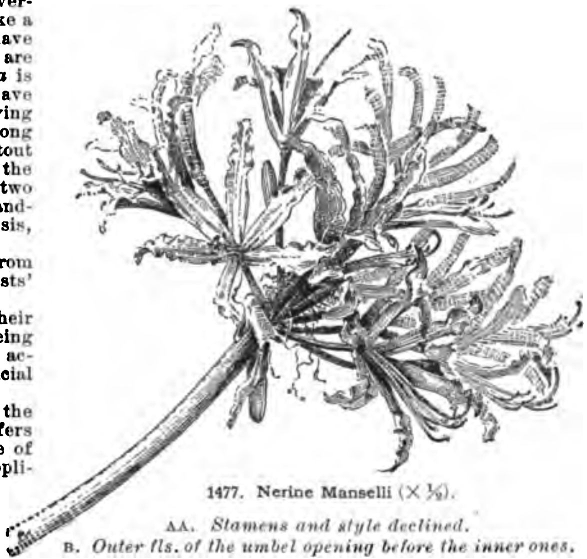
A. *Stamens and style nearly erect.*

B. *Lvs. green, suberect.*

1. **Sarniénsis,** Herb. GUERNSEY LILY. Lvs. linear, not curved laterally: fls. bright crimson; perianth segments hardly crisped. B. M. 294.—Var. **Plántii,** (*N. Plántii*, Hort.) has a longer scape, duller fls., and more distinctly clawed segments. Gn. 21:329. Var. **venústa** has bright scarlet fls. produced earlier than any of the other varieties. B.M. 1090 (as *Amaryllis venusta*). Var. **ròsea** has lvs. darker green than the type: fls. rose-red: seeds oblong instead of globose. B.M. 2124 (as *N. rosea*). Var. **corúsca** (*N. corúsca*, Herb.) has bulb tunics not chaffy: lvs. broader than in the type, with distinct cross-bars between the main veins: fls. large, bright scarlet. B.M. 1089 (as *Amaryllis humilis*). Gn. 21:329. *N. corusca major* has rich crimson-red fls. Var. **carnòsa,** Van Tubergen, carmine rosy. Var. **insignis,** Hort. Krelage, is considered by Baker synonymous with the type, but is probably horticulturally distinct. The flowers are said to be rosy.

BB. *Lvs. glaucous, sickle-shaped.*

2. **curvifòlia,** Herb. Lvs. strap-shaped, curved laterally, thicker than in *N. Sarniensis:* fls. bright scarlet: perianth segments hardly crisped. B.M. 725 (as *Amaryllis curvifolia*). R. B. 22:13.—Cult. only in the form of var. **Fóthergilli** (*N. Fóthergilli*, Roem.), which is more robust in all parts (Fig. 1476): fls. more numerous, between crimson and scarlet. Gn. 22, p. 463. Var. **Fóthergilli màjor** (*N. Fóthergilli màjor*, Hort.) is a form with still larger fls. F.R. 1:675.



1477. Nerine Manselli (× ½).

AA. *Stamens and style declined.*

B. *Outer fls. of the umbel opening before the inner ones.*

C. *Segments distinctly crisped or fluted.*

3. **flexuòsa,** Herb. Scape flexuous, longer than in the other kinds, sometimes 2–3 ft. long: fls. generally pale pink. Var. **pulchélla** has glaucous lvs., firmer than in the type: scape not flexuous: fls. pale pink, keeled rose-red. B.M. 2407 and Gn. 21:329 (as *N. pulchella*). *N. flexuosa*, var. *pudica* was offered in 1890 by Reasoner Bros. *N. Mánselli*, O'Brien, Fig. 1477, is a fine hybrid between *N. flexuosa* and *Fothergilli*. Gn. 56:1460.

CC. *Segments hardly crisped.*

4. **pùdica,** Hook. Lvs. 4–6, glaucous: umbels 4–6-fld., the other kinds being 8–20-fld.: fls. white, keeled pink above, ¼ in. wide; stamens a little shorter than the perianth. F.S. 22:2464. Gn. 21:329.—Showy, not spidery.

BB. *Outer fls. opening after the inner ones.*

C. *Length of perianth segments ½–¾ in.*

5. **undulàta,** Herb. Fls. pale pink, very much crisped. B.M. 369 (as *Amaryllis undulata*).

CC. *Length of perianth segments 1–1¼ in.*

6. **hùmilis,** Herb. Scape often smaller than in the other kinds, ½–1½ ft. high: fls. bright pink or rose-red, somewhat crisped. B.M. 726 (as *Amaryllis humilis*). Gn. 21:329.—Var. **spléndens,** Hort. Krelage, is presumably the best form of this species. Fls. purple-crimson.

The following names are mostly important hybrids which in many cases are more popular than the species: *N. amábilis* (pudica × humilis), rosy, dark-striped. Var. grandiflora, Hort. Van Tubergen, has larger fls.—*N. críspa*, Hort. Thorburn, scarlet.—*N. élegans* (flexuosa × Sarniensis, var. rosea), pink. Var. carminata, cerise. Var. cœrulea, shaded blue.—*N. excéllens*, Moore (flexuosa × humilis, var. major), carmine rosy, dark-striped.—*N. Hàylocki* (curvifolia × flexuosa, var. pulchella). One of the oldest hybrids in cult. Raised by Wm. Herbert. The others in this list are more modern.—*N. Japónica*, Miq.=Lycoris radiata.—*N. Mánselli* (flexuosa × curvifolia, var. Fothergilli), warm pink, late. See No. 3.—*N. Méadowbankii* (Sarniensis × curvifolia, var. Fothergilli).—*N. O'Brieni* (pudica × Sarniensis, var. Plantii). Var. cœrulea, Van Tubergen, pale violet, tinged blue.—*N. tardiflòra*, Hort. Van Tubergen, not accounted for by Baker. Fls. bright red in Dec.

W. M.

NÈRIUM (ancient name for Oleander, supposed to be from Greek *neros*, "moist;" alluding to the places in which it grows wild). *Apocynàceæ.* The Oleander is an old-fashioned evergreen shrub known to everybody, and cultivated everywhere in southern countries. The Bermudas, especially, are famous for their Oleander hedges. In the North the Oleander is a common house plant, being grown in tubs for summer decoration, and ranking in popularity after the sweet bay and hydrangea. It attains 7–15 ft., and blooms in summer, the fls. being salver-shaped, 5-lobed when single, 1½–3 in. across, and commonly pink or white, though the colors range from white through creamy white, blush, rose and copper color, to crimson and dark purple, with variegated forms.

The genus contains only 2 or 3 species. They are glabrous shrubs: lvs. in whorls of 3, rarely 4 or 2, narrow, leathery, transversely feather-veined: fls. in terminal cymes; calyx with many glands inside at the base; corolla-tube cylindrical at the base; throat bell-shaped and containing 5 wide or narrow teeth; lobes twisted to the right; anthers 2-tailed at the base and tapering at the apex into a long, thread-like appendage; style 1: ovaries 2, forming pods; seeds twisted.

Oleanders are of easy culture, and are well adapted to city conditions. Their chief troubles are scale and mealy bug. The scale should be sponged off; the mealy bug is easily dislodged by the hose. Sometimes a plant forms buds which open poorly or not at all. This is often due to the imperfect ripening of the wood. The fls. are borne on the growth of the year, which should be well ripened in June in order to set many strong buds. For this purpose give the plants plenty of light and air, and water more sparingly when the vegetative growth seems to be finished. After flowering, give the plants less water. Protect them from frost in winter; keep them, if necessary, in a light shed. In April, prune back the old wood which has borne fls. and give more warmth and water. The ripened leading shoots can be rooted in a bottle of water. Oleanders are poisonous, and some people have died from carelessly eating the fls. Cattle have been killed by eating the foliage. E. S. Miller writes: "We have good success in rooting ripe wood in the winter. The cuttings remain 3 to 4 weeks in the sand, with moderate bottom heat. They grow like weeds when potted." W. M.

1478. Spray of Oleander—Nerium Oleander.

Oleanders in the East.—The Oleander is becoming somewhat fashionable again, especially the double-flowered variety of cerise color. The following method of Oleander culture has been pursued by the writer with success. Propagation is performed after the flowering period. Good-sized cuttings are taken, and every one grows. When rooted, the cuttings are potted in small pots and kept barely alive over the winter. They will need scarcely more attention than geraniums until February or March, or whenever growth becomes more active. Later in the spring the young Oleanders are planted outdoors in the open ground, in good rich loam or garden soil. (This is sometimes done with ivies or euonymus, but the common method is to plunge the pots outdoors during summer). Take up the Oleanders in September, pot them and bring them indoors for their second winter. The following spring the plants will bloom, but they will not be shapely. The time has now arrived to train them, either as bush plants or crown standards. Top them at whatever height is desired, say 2 or 3 feet, and the plants will make good crowns the same season (i. e., their second summer). Do not allow the plant to bloom the following spring, (which is its third spring), and the result will be a fine specimen in full flower for the fourth summer.

H. A. Siebrecht.

Oleanders in California.—Oleanders are much grown in S. Calif. and would be extremely popular were it not for black and other scales, which seem to prefer them to everything else. We have five colors here, perhaps all of the same species—white, light pink, dark pink, scarlet and buff. Most of these colors, if not all, can be had in both single and double forms. The writer has never seen an Oleander more than 15 ft. high, but he believes they will grow larger. One Los Angeles man planted the red variety thirteen years ago for sidewalk trees. (For this purpose, if cleaned of scale when necessary, the Oleander is one of the very best.) The trees are heavily pruned and topped each year. They are now 12 ft. high and 4–5 in. in diameter at base. Oleanders need no attention here, and are as readily propagated from hardwood cuttings as willow. They are very floriferous, and the inflorescence comes out in large, heavy heads, necessitating a close pruning to make them self-supporting. Ernest Braunton.

A. *Fls. not scented.*

Oleánder, Linn. Oleander. Rose Bay. (Another plant called Rose Bay is *Epilobium angustifolium*.) Fig. 1478. Lvs. in 2's or 3's, lanceolate: appendages of the anthers scarcely protruding: segments of the crown 3–4-toothed. Mediterranean region, Orient. Gn. 51, p. 81 (fine trees in vases). A.F. 10:265 (Bermuda shrub with a spread of 25 ft.). L.B.C. 7:666 (var. *Loddigesii*, with a variegated fl. and the appendages entire, ovate and obtuse). *N. album*, *atropurpureum*, *carneum* and *roseum*, Hort., are doubtless varieties.

AA. *Fls. scented.*

odòrum, Soland. Sweet-scented Oleander. Lvs. in 3's, linear-lanceolate: appendages of the anthers protruding: segments of the crown 4–7, long and narrow. Persia, India, Japan. B.R. 1:74. B.M. 1799 and 2032.—A less robust plant, with lvs. commonly narrower and more distant, and angled branches. In wild plants the calyx-lobes of *N. Oleander* are spreading; of *odorum* erect. Not advertised but cult. Has some range of color and single and double forms. W. M.

NERTÈRA (Greek, *lowly*; referring to the habit). *Rubiàceæ.* The Bead, or Coral Bead Plant (*N. depressa*) is a hardy perennial Alpine or rock plant which forms a dense mat of foliage covered with orange-colored, translucent berries the size of a pea. The genus comprises 6 species of similar habit found in the mountains of the southern hemisphere. The best of the genus, probably, is *N. depressa,* which ranges throughout the Andes, from the tropics to Cape Horn. It also inhabits Tristan d'Acunha, and the mountains of New Zealand and Tasmania. The Bead Plant is prop. by seed or division. It needs a sandy soil, with some leaf-mold, and prefers shade in summer. It may need some winter covering in the North. It makes a good house plant and well-fruited specimens are occasionally used abroad in fancy bedding as a novelty. The fruit may last from midsummer well into the winter.

Nerteras are slender creepers, with small, opposite lvs. which are stalked or not, ovate or ovate-lanceolate; stipules grown into a sheath with the petioles, 2-dentate or entire: fls. axillary, inconspicuous, sessile; corolla 4-lobed; stamens 4: ovary 2-celled; drupe 2-seeded.

depréssa, Banks and Soland. Almost glabrous: stems 6-10 in. long, 4-cornered: lvs. 2-4 lines long, broadly ovate, acute or obtuse, leathery or almost fleshy; petioles about as long as the blades; stipules very small: fls. solitary, greenish. F.S. 21:2167 (charming). B.M. 5799. W. M.

NESÆA. See *Decodon.*

NETTLE. *Urtica.* **Dead N.,** *Lamium.* **False N.,** *Bœhmeria.* **Tree N.,** *Celtis.*

NEVADA, HORTICULTURE IN. Fig. 1479. The northwestern part of the state along the eastern slope of the Sierra Nevada mountains is the chief fruit section. In the southern part of the state, which is also near the Sierra Nevada mountains, some very fine semi-tropical fruits are grown, but lack of transportation facilities prevents their more extensive production as yet.

There are possibly 1,500 acres planted in apple trees, a great many of these being young trees, not yet in bearing. As to other fruits, the acreage planted is small, as they can be sold only in our home market, which is very limited. Some of the largest apple orchards contain 30-50 acres each. An orchard of 30 acres in full bearing would produce about 6,000 boxes of marketable apples, worth here $1 per box; the expense of everything connected with them would be about $1,000.

All fruit and other crops require irrigation. The water for irrigation is obtained from rivers and creeks, and sometimes from reservoirs. The water is sometimes run all over the ground and sometimes in furrows.

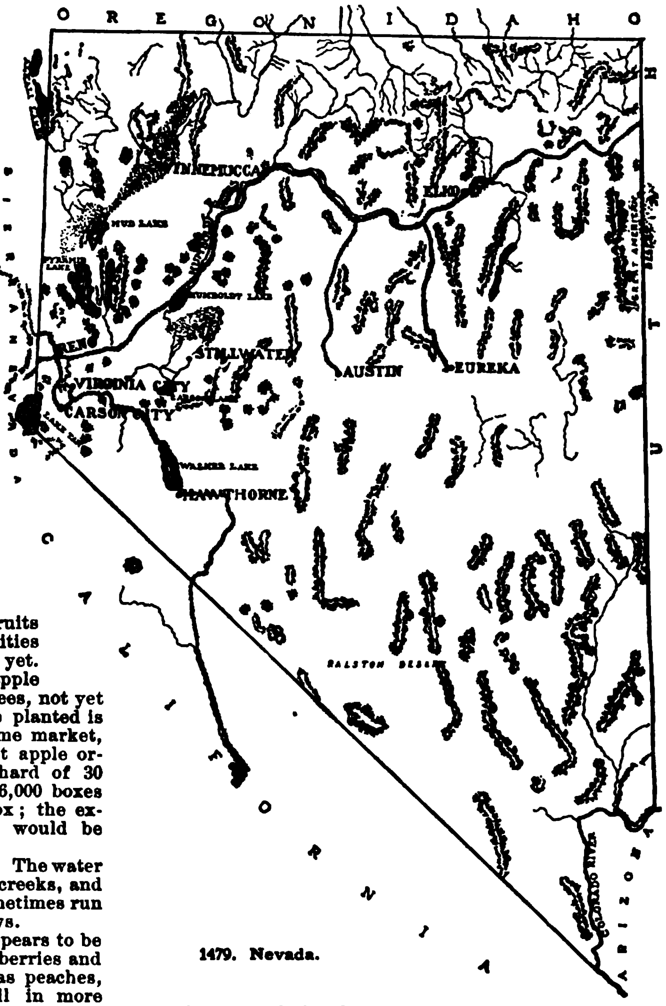
Black, sandy loam with a granite base appears to be the best soil for apples, pears, plums, raspberries and strawberries. Some kinds of fruits, such as peaches, plums, prunes, strawberries, etc., do well in more compact soil derived from slate and volcanic rocks All Nevada soils are well supplied with iron, and some have a very high percentage of potash. An elevation of from 4,000 to 5,000 feet seems best for hardy fruits. The price of good orchard land is about $200 per acre, and of bearing orchard about $500 per acre; this includes water.

None of the fruit is subject to injury in winter; the only time it is liable to injury is in May, when the trees are in bloom.

The San José scale has appeared in a few places. The woolly aphis and green lice are sometimes troublesome on young trees and grafts. The codlin moth also is present in some places.

Of apples the following are cultivated: Newtown Pippin (both yellow and green), York Imperial, Spitzenburg, Jonathan, Pilot, Smith Cider, Wagener, Buckingham, Grimes Golden Pippin, Northern Spy, Wine, Wine Sap, Strawberry, Rome Beauty, Ben Davis and Pioneer. Other kinds of fruit are grown only for the local market, and their production is very limited. No new varieties seem to have originated in the state as yet. ROSS LEWERS.

NEVIÙSIA (after Rev. R. D. Nevius, who discovered it.). *Rosàceæ.* This is a very rare shrub which grows wild only on some shaded cliffs near Tuscaloosa, Ala. It is, however, quite hardy as far north as Philadelphia. Its long, slender, wand-like branches remind one of Kerria, but it has no petals, and its beauty is after the Spiræa kind. The fls. are about an inch across, 6 or 8 in a cluster, and the clusters strung along 2 or 3 ft. of wand-like stem, forming ropes of feathery bloom. This fringe-like beauty is caused by the numerous white filaments of the stamens. Botanically this genus is a puzzle, but it is probably nearer Rubus than Spiræa. Generic characters are: calyx-tube small, flattish, persistent; lobes 5, large, spreading, leafy, serrate, imbricate; petals 0; stamens in many series, persistent; disk flattish, enclosing the calyx-tube; carpels 2-4, small, sessile, silky; styles incurved at the apex; ovules solitary, hung from the top of the cell: akene drupaceous, small, included by the ample calyx.

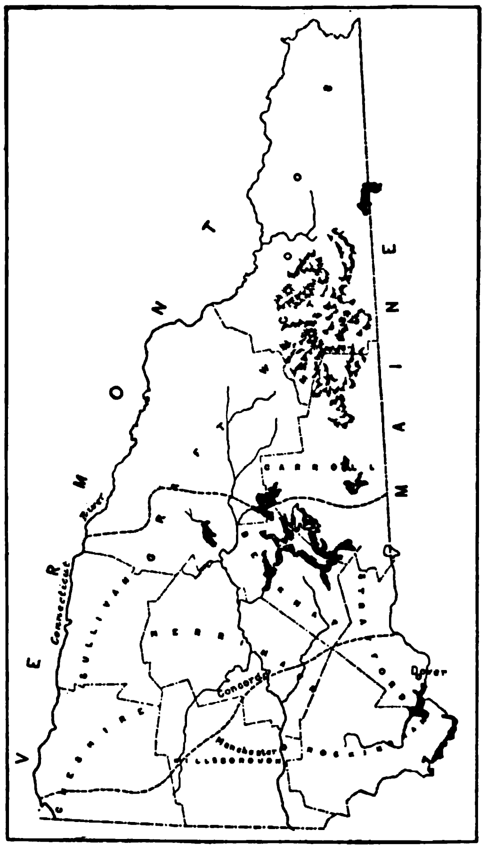


1479. Nevada.

Alabaménsis, Gray. SNOW WREATH. Height 3-7 ft.: lvs. alternate, petiolate, 1½-3½ in. long, pale green, ovate or oblong-ovate, usually doubly serrulate; petioles 3-6 lines long. B. M. 6806.—Alfred Rehder writes that it is hardy at the Arnold Arboretum (at least in a sheltered position), and blooms every year.

NEW HAMPSHIRE, HORTICULTURE IN. Fig. 1480. Horticulture in the Granite State began almost with the first settlement. In 1623 Ambrose Gibbons set the first vineyard, together with other fruits, near the mouth of the Piscataqua river, now Portsmouth. There are many such old horticultural landmarks.

The native fruits are only too abundant in the state at the present time. The old idea that the destination of the apple was the cider barrel got so strong a foothold in some sections that, as the virgin soils began to decline and the wheat crop and its associates in agricultural operations moved on to the West, it was not thought worth while to adopt modern methods of fruit-growing. In other sections, however, quite the reverse is true, as there are signs of awakening at later dates. Some towns are noted for their large areas of old orchards still in bearing but rapidly declining. In one town where from 20,000 to 30,000 barrels of apples have been shipped in a fruit season, the industry has now nearly run out. However, the land containing these old trees is, it is said, worth twice as much as other land. Comparatively few new trees have been set in this section, and it is found that the whole industry is the result of one man's interest and labor two generations ago.



1480. New Hampshire, with three cultural divisions.

In some places grafting the native apple trees to Baldwins or the improved fruits has been very extensively practiced, with good results. Where this has been done, however, the trees are now old, and as cultivation and renovation of orchards have scarcely ever been practiced, they are naturally on the decline.

While these conditions are not flattering, they nevertheless show what must be overcome in the future. However, it is surprising to see what a quantity of fruit is raised in favorable seasons, and this goes to show that under intelligent and progressive management success will be assured.

At present the horticultural interests are gradually being better understood, and the trend has begun in the right direction. There are many things accountable for this awakening. The people are coming to realize that there are newer and better methods, and that the new agriculture stands for more business and energy. The development of this condition is coming through the efforts of the grange, experiment stations, the agricultural press, State Board of Agriculture, and agricultural teaching in state colleges,—all of which have in the main the same objects in view.

Here and there young orchards are being set, and the predictions are that the near future will find New Hampshire as one of the best fruit states. The Baldwin apple is the standard variety throughout the southern part of the state. In the northern part of the state the Bethel is being planted and, it is thought, will be to this section what the Baldwin is to the other. Almost all other varieties common to New York are grown with equally good success. Even in the White Mountain region it is being demonstrated that orcharding is a worthy industry. A list of apples adapted to the northern part of the state, named in order of their ripening, as furnished by Mr. J. D. Howe, of Lancaster, a large fruit-grower, is as follows: Yellow Transparent, Tetofsky, White Astrachan, Red Astrachan, Peach, Duchess of Oldenburg, St. Lawrence, Alexander, Fall Jennetting, Fameuse, Wealthy, Nodhead, Porter, Talman Sweet, Gideon, Bethel, McIntosh Red, Twenty Ounce, Yellow Bellflower, Northern Spy, Stark and Ben Davis.

Pears and plums do very well generally throughout the state. Peaches do fairly well in the southern part. During 1897 and 1898 there was a very fine crop. The varieties of greatest value are Mountain Rose and Early Crawford. Small fruits generally are easily grown in the state.

The wild grapes found quite commonly on the stone walls and hedges in the southern part of the state are not the native varieties, but wildings showing indications of *Vitis vinifera* blood. Many of them are very palatable and valuable.

New Hampshire has many advantages for horticultural work. The markets are usually good and within easy access; and the great number of summer boarders also makes a ready market. It is also within easy reach of exporting stations, which in seasons of large crops is an advantage.

F. Wm. Rane.

New Hampshire is a small state, and may well be called a land of horticultural possibilities rather than achievement. With some of the best markets in the country within a day's journey, and the rapid extension of electric railroads, both in mileage and usefulness, there seems no good reason why all the hardier kinds of fruit may not be raised at a profit.

The southern half of the state is hilly but can hardly be called mountainous. Through it run several fertile valleys with excellent opportunities for gardening and small-fruit raising. The uplands produce apples of fine quality even under the present system of neglect, and it would seem that in this whole region commercial horticulture must become more and more profitable and popular, as improved methods of culture are adopted.

The White Mountains cover the greater part of the northern half of the state; here, the entertainment of tourists and visitors in summer, and lumbering in winter will probably continue to be the leading industries, unless rational methods of forest management are too long postponed.

It is recorded that a vineyard and other fruits were set out on the eastern coast of New Hampshire as early as 1623. Doubtless much of this succumbed to the severity of the long winters, and it is the apple alone that stands out preëminent in horticultural history as the fruit of the Granite State. Many of the early settlers came from the southwestern counties of England. To them cider and perry seemed almost as necessary as food, and very soon after their arrival they began to set orchards of apples and pears. Their particular object was not the fruit itself, but the beverages made from it. The following item is taken from one of the many town histories that have been published in New Hampshire, and although it may be slightly exaggerated, it gives some idea of the apple industry one hundred years ago:

"About this time—1800 to 1810—the apple orchards in town which had been early set out, produced apples in abundance, which were made into cider. Every man had his orchard, and every tenth man his cider-mill. Every well-to-do farmer put into his cellar yearly from 20 to 50 barrels of cider which was all drunk on the premises. Col. John Bellows had an orchard of 30 acres, the largest in town. In 1805 there were 4,800 barrels of cider made and every drop drunk in town."

At the present time a good many old and somewhat neglected apple orchards are to be found, and these often bear good crops of marketable fruit. At the annual meeting of the New Hampshire Horticultural Society in January, 1899, it was estimated that $2,000.000 worth of apples were exported from the state in 1898. Of these about one-half were raised in the two southeastern counties—Strafford and Rockingham.

The varieties most commonly grown for export are Baldwin, Rhode Island Greening, Northern Spy, Fameuse, Blue Pearmain, Yellow Bellflower, and King. The newer varieties are of course being introduced, but very few large orchards are being set. Summer and fall apples are abundant for local consumption.

Very little has been done in a commercial way with the drupaceous fruits. Plums are successfully raised on a small scale. The Lombard is undoubtedly the favorite variety, although the Japanese plums appear to be able to withstand the climate, and are rapidly growing in favor.

Peaches are raised in a few somewhat isolated instances, and it is worthy of note that the peach-growers of five years ago are still in the business. The introduction of this fruit as a money crop is of such recent date that records are hard to obtain, but it is estimated that three crops in five or possibly six years is about the average production. Perhaps hardier varieties will be developed as time goes on. The Barnes peach, a New Hampshire seedling, is a step in this direction. Its originator describes it as being "of good size and color, a freestone, with very yellow and solid flesh of fine flavor." "It ripens in the southern part of the state about Sept. 10, and is the hardiest in wood and bud of anything yet fruited here."

Market gardening and the raising of small fruits receive some attention, especially in the Merrimac river valley.

Greenhouse gardening is carried on to a limited extent near the larger towns and cities. Flowers receive their full share of attention, but a good many winter vegetables are still imported from the neighboring state of Massachusetts.

The New Hampshire Horticultural Society was organized in December, 1893, and after a year of prosperity was granted an appropriation of three hundred dollars a year by the legislature. This sum enabled the society to hold an annual exhibit in each of the two following years, and also several institutes in different parts of the state. The legislature which met in January, 1897, however, failed to make the appropriation, and the society was compelled to rely upon its officers and members to carry on the work. The annual exhibits were then held in connection with the State Grange Fair.

A department of horticulture was established at the New Hampshire College of Agriculture and the Mechanic Arts, at Durham, in 1895 and has grown in both usefulness and influence.

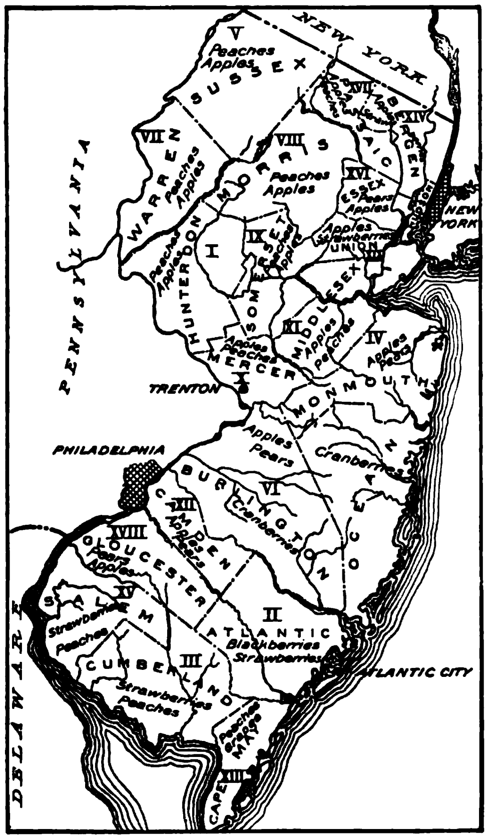
With the two last-named powers for good, working for the advancement of horticulture in the state, and the fact that emigration from the farms to the cities is rapidly decreasing, if not already reversed, it is to be hoped and expected that within the next decade New Hampshire will rank as a horticultural state, judged not so much by the gross amount of the output, as by the quality of her products, and the intelligence of the producers.

J. A. Foord.

NEW JERSEY, HORTICULTURE IN. Fig. 1481. The state of New Jersey, situated as it is between the large markets of Philadelphia on the one side and Newark, Jersey City and Greater New York on the other, is almost necessarily a market-garden and fruit-growing state. The soils found in the different sections also contribute to this end. In the northern part, disintegrating sandstone and slaty formations abound—a soil in which the peach does its best. The sandy soils of South Jersey make that part of the state noted for its truck, berries, etc. Between these two classes of soils are found others of all grades, in one or another of which nearly every kind of fruit and vegetable finds a congenial habitat.

It is estimated that there are in New Jersey approximately 34,000 farmers. A little more than one-tenth of these are engaged in commercial pomology—commercial in that they are growing fruit for market, depending on their fruit-product for the money-crop of the farm. Those who have planted larger or smaller areas primarily for home use, yet in good years have a surplus to dispose of, are not included in our data. The total area represented is something over 41,000 acres, including all counties of the state except Ocean, from which no commercial orchards are reported, and gives an individual average of 12¼ acres. This average acreage may be all of one kind of fruit, or it may be two acres each of a half-dozen kinds, as the case may be. Individual acreages range from one acre in the case of berries to 100 and 150 acres for peaches.

The fruit of fruits for the state is the peach. The area devoted to its culture exceeds that of all the other tree and small fruits combined by nearly 100 acres. In the distribution of this area, a little over 83 per cent is found in the five northern or northwestern counties, i.e., Hunterdon, Sussex, Warren, Morris and Somerset, named in order of importance, though with its present rate of increase Sussex will soon be first in area.



1481. Horticultural regions in New Jersey.

The second fruit in importance is the apple, although the area devoted to its culture is a little less than one-third that devoted to peaches. The other fruits, in order of importance in total areas, are strawberries, pears, blackberries, raspberries, grapes, currants, cherries, gooseberries, quinces and plums.

These fruits are all grown to a greater or less degree in the different parts of the state, but those mentioned, except peaches and apples, are more largely grown in the southern sections. The central part of the state is the chief apple producer, while the northern, as we have seen, is the peach section. In the accompanying skeleton map (Fig. 1481) the numbers in the county indicate its relative importance in total acreage devoted to fruits, 1 being the largest. The names of the two fruits most largely grown in the different counties is also given. While this well shows the general distribution of the principal fruits, it does not give the chief growing centers for all the fruits, which are as follows (by counties):

Apples.	*Pears.*	*Peaches.*	*Strawberries.*
Monmouth, Burlington.	Burlington, Monmouth.	Hunterdon, Sussex.	Cumberland, Atlantic.
Blackberries.	*Grapes.*	*Raspberries.*	*Currants.*
Atlantic, Cumberland.	Cumberland, Atlantic.	Atlantic, Monmouth.	Burlington, Essex.
Gooseberries.	*Cherries.*	*Quinces.*	*Plums.*
Burlington, Camden.	Burlington, Camden.	Burlington. Cumberland.	Camden, Burlington.

Only in two counties, Burlington and Camden, are all these fruits reported. In Cumberland all are grown commercially except currants and gooseberries, while in Essex the exceptions are blackberries and plums.

The cranberry industry of the state is considered apart from the above fruits. The annual yield is second only to the output of the New England bogs, with an occasional year when it exceeds that of New England. In quality of fruit New England does not bear the palm. Burlington county is the chief center of the industry, though cranberry bogs are scattered throughout the southern half of the state. From 100,000 to 125,000 bushels is the approximate annual yield from Burlington county; Ocean county, from which no other fruits are reported, is second in cranberry-growing, with an annual yield of approximately 30,000 bushels.

The truck industries of the state are large and varied, but confined chiefly to the southern half. Monmouth county is a section producing asparagus and tomatoes, as well as other vegetables in wholesale quantities. As an illustration of the extent of the asparagus industry, the shipment of "grass" from one little way-station amounted in one month to over 100 tons, beside quantities sent by boat from a near-by landing.

The sweet potato is another of Jersey's noted products that is grown in large quantities. They are admitted to be the "sweetest of the sweets."

Vegetable-forcing is a growing industry that is as yet in its infancy. Already there are several plants approaching in size those that have made Arlington, Mass., famous.

The growing of cut-flowers is another horticultural industry that has assumed immense proportions. The northeastern part of the state is the center of this industry. Roses, carnations, chrysanthemums, violets, mignonette and smilax are probably the most important ones grown to supply the trade. To say that the industry is large does not convey the right idea of its extent. The fact that the value of roses alone annually reaches into the hundreds of thousands of dollars will bear out the statement that "the growing of cut-flowers has assumed immense proportions." A. T. JORDAN.

NEW JERSEY TEA. See *Ceanothus.*

NEW MEXICO, HORTICULTURAL PROSPECTS OF. Fig. 1482. New Mexico includes so many diverse conditions of climate and soil that no statements can be made on horticultural subjects which are applicable to the whole area. Indeed, every valley has its own special features, and the problem of the future is to find or develop such fruits, vegetables, cereals, and forage plants as are best adapted to the several localities, so that each cultivated area may produce a maximum crop of the best quality.

While it is impossible to enter into details within the limits of a short article, it may be said, in brief, that the following zones are well represented and of horticultural importance in New Mexico:

(1) Canadian zone: at about 8,000 to 9,000 feet. Cereals can be cultivated successfully, and good pasturage is found; but fruit trees, with one or two possible exceptions, will not withstand the cold. Irish potatoes do very well in this zone. In this zone crops are often grown without irrigation, as on the Sacramento mountains in Otero county.

(2) Transition zone: at about 7,000 feet, as at Santa Fé. The deciduous fruit trees and all sorts of small fruits do admirably. Corn also does very well, and sugar beets have been grown with much success.

(3) Upper Sonoran zone: at about 5,000 to 6,000 feet, as at Albuquerque. Sweet potatoes and the European grapes do very well, and the deciduous fruit trees are largely grown. This is a good peach region, but apples are less profitable than formerly, owing to the abundance of the codlin moth, which increases very rapidly owing to the warm climate.

(4) Middle Sonoran zone: somewhat lower than the last, as in the Mesilla valley and at Deming. Horticulturally, this resembles the last, but its native products resemble those of the Lower Sonoran. (See American Naturalist, April, 1900.) Cotton can be grown, but is not considered as a possible source of profit.

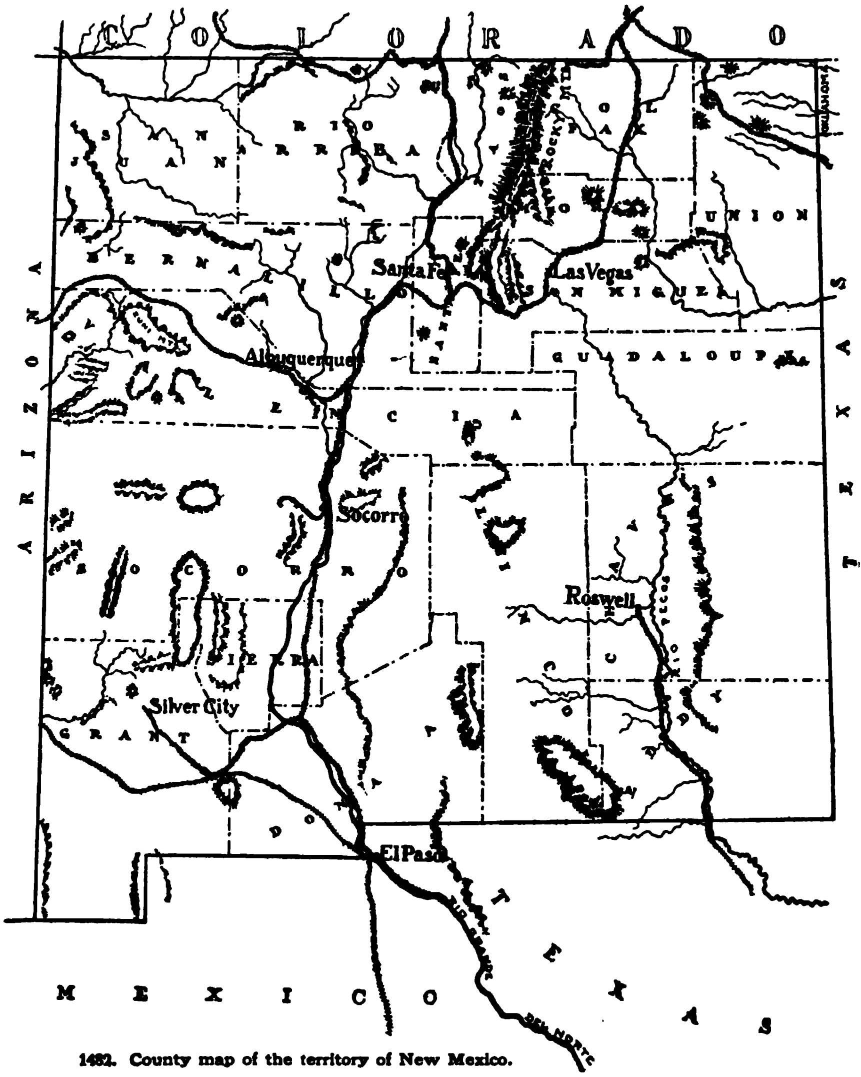
T. D. A. COCKERELL.

New Mexico lies altogether above the altitude of 3,000 feet. Some cultivated valleys, in which many fruits and vegetables succeed, are as high as 7,000 feet. This is the altitude of Santa Fé, where gardening and orcharding are successful. It is mostly a country of mountains and mountain valleys. The mountains reach to 14,000 feet. The average height of New Mexican valleys and arable areas probably exceeds 5,000 feet. While the territory is very large, the area of the mountain districts and of the arid and untillable hillsides is so great in proportion that the lands suited to farming and horticulture which can be irrigated when all water resources are utilized, will not much exceed 2,000,000 acres. A small proportion of this amount is at present in actual cultivation. Of the acreage under cultivation, agriculture claims the larger share.

There is a possibility that as much as 500,000 acres may ultimately be devoted to horticultural uses. The preëminent adaptability of these soils, and of this climate, to all the garden, vineyard and orchard crops of temperate latitudes, leads one to hope that the laws of supply and demand will finally consign a large portion of these arable lands to the uses of horticulture. The precise conditions for successful horticultural production are found in narrower areas in America than those that favor common farm crops; hence when the demands of the future American population crowd the resources of supply of the higher orders of human food, it will of necessity follow that the soils and conditions that will yield the largest amounts of the most valuable foods will be devoted to these ends. As this time draws near—a quarter to a half-century hence—the resources of New Mexico for the growth of the most important crops will surely be developed. The soils possess inexhaustible richness of mineral elements, and under good husbandry are permanently fertile. The great average elevation above sea-level gives exemption from most of the destructive plant diseases of humid climates, hence surer, cheaper, better and larger crops. The altitude gives moderate summer temperatures, while the latitude protects against severe winter cold. The grapes of Spain and Italy are grown with little or no protection. In fact, the perfect salubrity of the climate renders horticulture easy in nearly all its branches.

It must be understood that crop-growing in New Mexico is largely dependent on irrigation. There are moderate annual rains, which mostly fall in summer. The average rainfall is about 12 inches. Most of the crops require as much more. The standard of water supply of the irrigation companies is 12 inches. The possible limits of irrigation farming in the old states are very narrow.

Stated in brief terms, irrigation costs money and energy and some skill, but its rewards are great and sure. The farmer in the rainfall states does well if he makes two acres of land keep one cow or horse or steer summer and winter. Here one acre will carry two animals. In a great measure this applies to the crops of the garden and the orchard. There need be no droughts nor floods; the land can be made to do its full duty every season. There is no doubt that the average weight of garden and orchard crops in any ten years under wise irrigation will be twice as great as in most regions in which it is considered unnecessary or impossible. Hence it seems that within the limited districts of the semi-arid belt of the United States that are susceptible of irrigation, there is an important field for the horticulturist. In this field he will find his greatest rewards. Lands in horticultural crops will produce from two to ten times as much necessary human food as lands under the common crops of agriculture. The parts of this continent in which irrigation horticulture is possible is but a small fraction of the whole area. New Mexico has probably a larger proportion of irrigable lands adapted to horticultural use than any of our states or territories.



1482. County map of the territory of New Mexico.

All garden crops succeed well in all parts of New Mexico where water can be commanded for the land. All orchard crops succeed admirably in some parts of the territory, and the most important of all, the apple, is a successful crop in nearly all parts. In that portion of the territory lying on the eastern slopes of the Rocky mountains, in the counties of Lincoln and Chaves, the apple seems to reach its most perfect development. There are beautiful apples without blemish grown in many parts of the arid west and along the Pacific coast; but in too many cases the fruit is disappointing in quality. But in the counties named all varieties of apples that have been fruited show a very high apple quality. The freedom from defect is remarkable, and the unexampled beauty of color and clear complexion in bushel after bushel as they come from the trees is a constant surprise. The Yellow Bellflower and Newtown Pippin reach great perfection.

In most of the old apple-growing states, the apple is subject to many insects and diseases. In the arid region of the country we have escaped many of these evils. While we shall not escape all the troubles of the orchardist, yet the elevation of the country, the control of the water supply, the purity and dryness of the air and the everlasting sunshine will combine to protect from those serious evils born of humid climates and low altitudes, or that result from weather conditions where man has destroyed the delicate balance of the seasons by the widespread destruction of native forests. It is apparent to some of us that this wide, high region, which never had great areas of forest to be destroyed, possesses more permanent conditions of successful fruit-growing than are possible in any country where the vicissitudes of flood and drought, of great cold and great heat, are the inevitable associates of the year.

PARKER EARLE.

In New Mexico the apple grows very well. The counties of Chaves and Lincoln in the southeast, San Juan and Santa Fé in the north, and Grant and Doña Ana in the south, are well known for their fine apples. Four varieties from Mesilla Park, in Doña Ana county, received second premium at the World's Exposition, in Paris, 1900. The following are the varieties: Ben Davis, grown by Frank Burke; Missouri, Pippin, grown on the famous Woodland Orchard; and the Gano and Lawver, from the Agricultural college. At present the apple is free from the common diseases. The only insect enemy is the codlin moth, which in some sections is coming to be a serious pest. The early varieties, such as the Red June, Red Astrachan, Early Harvest and Yellow Transparent, are almost free from the codlin moth, while on the other hand the late kinds, and especially the winter apples, are more largely attacked by this insect.

The pear grows as well as the apple, but not in such large areas. In most of the apple-growing sections the pear can be found in very limited quantities. However, there is a bright future for a more extensive cultivation of this fruit, as wherever it thrives it grows to a large size, and is fine in quality. The pear blight, which is so bad in other states, is not in the way of pear culture in New Mexico.

Perhaps the fruit that is second in importance at present is the peach, which is grown with more or less success throughout the territory. In the agricultural districts of southern New Mexico the large commercial peach orchards are located, and the Mesilla valley, on the lower Rio Grande, has the most and largest of them. From this valley many car-loads of early peaches are shipped to the markets of Chicago, Kansas City and Colorado. The early-ripening kinds, such as the Alexander, Waterloo, Hynes Surprise, are the most successful. This is due to the fact that, as a rule, the early-ripening peaches bloom later than the late-ripening varieties, and thus they escape the late spring frosts, which are so common in this territory and which are often so fatal to the late peaches. The late spring frost is the worst drawback to peach-growing in New Mexico. No diseases or insect pests have yet threatened the peach crop.

While the apricot grows as well as the peach, and has no insect enemies or fungous diseases, it has failed to be a commercial success on account of its blooming too early. If some late-blooming variety could be found, this fruit would, no doubt, be one of our best fruits to grow. The trees grow to a great age. There are many apricot seedlings on the lower Rio Grande that were planted by the Mexicans forty or fifty years ago.

The plum is making a place for itself in New Mexico. It has been but a comparatively short time since plums were considered to be of any importance, and even now the areas planted to plum trees are very small. However, conditions are changing, and there is a growing demand for them. The plum tree seems to be perfectly hardy in this climate. The Japanese plums are vigorous growers, but are not a success owing to the liability to late spring frosts. Their fruit buds seem to be stimulated to growing during the warm spells in February and March, and thus they bloom before the danger of frost is over. On the other hand, the *Prunus domestica* and *Prunus Americana* varieties are, as a rule, late bloomers. The former group is gaining in popularity throughout the territory. Imperial Gage, Yellow Egg, Coe Golden Drop, Damson and German Prune seem to be among the best varieties in the northern part of the territory. In the southern part, the above-mentioned varieties, with the addition of the Silver Prune, Clyman, Pond Seedling, Jefferson, and Robe de Sergent, are among the best.

Cherries grow well in the territory, but in the southern part they do not grow as large nor as fine as they do in the northern part.

Quinces and nectarines thrive in many of the horticultural districts, but as yet they are only grown for family use.

Perhaps the distribution of the grape is less extensive than that of the other fruits. Wherever the grape is grown it thrives. The American varieties are not of any commercial value. The fruit is usually small, bunches loose, and vines are poor bearers. The European kinds are a success, and are the grapes grown for market. Their culture is confined to the southern and hotter valleys, and particularly to the lower Rio Grande valley. The varieties planted in the commercial vineyards in this valley are the Mission or El Paso grape, Muscat of Alexandria, and more or less the Gros Colman and Flame Tokay. Other varieties are being introduced. The grape is free from fungous and insect pests. Even the phylloxera has not yet made its appearance. The Mission grape, which has been in cultivation for over a hundred years, shows how free the grape is from any pests. The only thing that injures the vines is the dry, cold winters. In order to obviate this trouble the vines are heeled up with earth 6 to 12 inches above the last year's growth. The stump method of pruning is practiced altogether in the grape culture. Attempts have been made to trellis the vines, but have not been very satisfactory.

The small fruits are grown with more or less success throughout the territory, but as yet they are of minor importance in the horticulture of New Mexico.

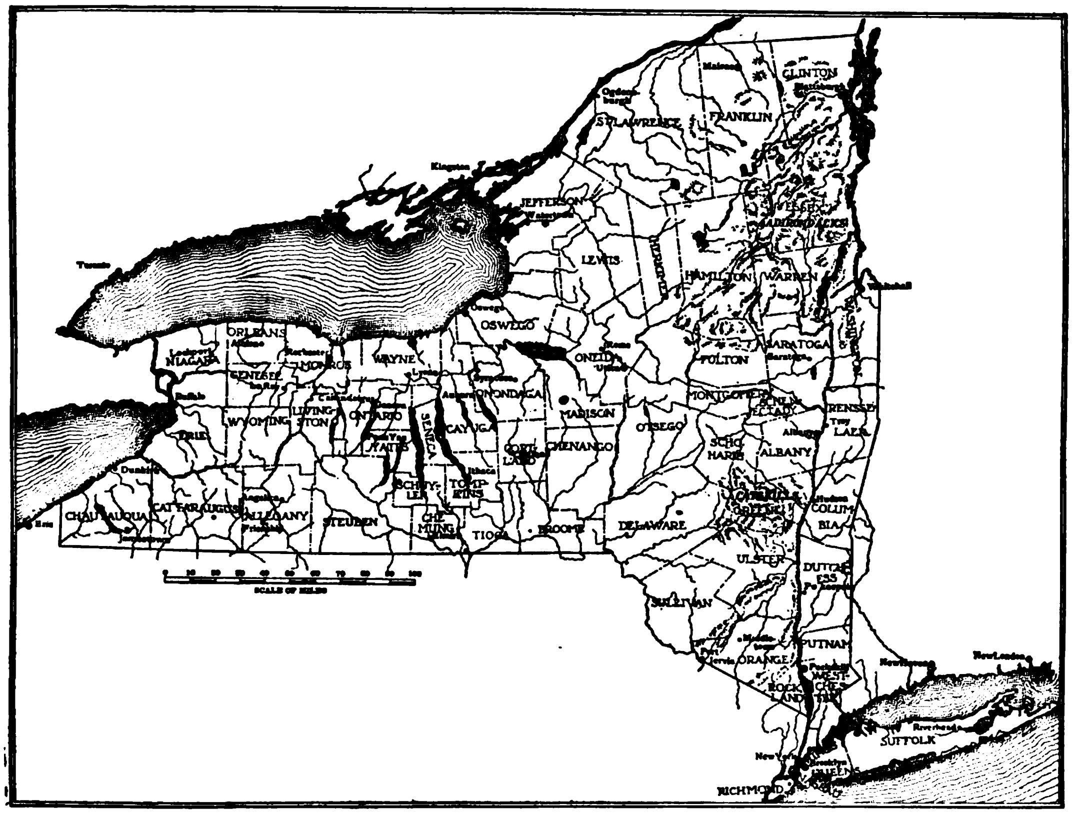
Fabian Garcia

NEW YORK, California and Florida may be reckoned as the great horticultural states. In range of species which can be grown, California and Florida excel. California excels in tonnage of many horticultural products. New York, however, excels in the great variety of its commercial horticultural interests, for to its fruit-growing must be added the very extensive nursery business, cut-flower growing, florists' plant-trade, seed-trade, and a great development of the vegetable gardening interests.

In shape and position New York (Fig. 1483) may be likened to a ship sailing westward, its rudder (Long Island) in the Atlantic and its prow touching the Great Lakes. Its commercial preëminence is supreme. A population of more than six million lives within its borders, and a million more are tributary to it in New Jersey and Connecticut. It has more than 40 cities with populations above 10,000. Great variety of soil and surface invites a varied population. Water-power is abundant and unfailing. All this means extensive markets for horticultural produce.

The land area of the state is 30,476,800 acres, of which about one-half is readily cultivable. The state has an extreme length east and west of 412 miles, and north and south of about 310 miles. Excepting a small area in the southwestern part, the entire surface is glaciated. In the northeastern part a true mountain system is shown in the Adirondacks, of archæan formation. In the middle eastern part, the Catskill highlands attain the dignity of mountains, although they are in reality eroded tablelands, having been laid down in the interior sea and subsequently uplifted. These highlands extend westward entirely across the state, being pronounced and almost mountainous in the southern half. The northern part of the western half of the state is relatively level, although the tract from Syracuse to Lyons and westward is marked by very bold drumlins,—the work of the ice-sheet. The bar-beach of the geological Lake Iroquois extends from near Niagara Falls to Oswego, paralleling Lake Ontario at a distance of about 10 miles. This geological beach is a distinct physiographical feature known as "the ridge," and it is the location of one of the notable highways of the state. This ridge marks the southward limit of the best natural peach region. There are fossil beaches on the Erie shore, and these are important to the grape-growing of Chautauqua county. (See Tarr, "Geological History of the Chautauqua Grape Belt," Bull. 109, Cornell Exp. Sta.) Long Island is a moraine, with an ocean-floor formation on its south, and this latter area comprises practically the only flat land in the state.

There are five great watersheds in the state. (1) the St. Lawrence system, draining the Great Lakes and the larger part of central and western New York. (2) The Hudson system, draining the southern slopes of the Adirondacks and the Catskill highlands, with its great tributary, the Mohawk, which, in pre-glacial times, was a part of the St. Lawrence system. (3) The Delaware system, draining a part of the southeastern area into Delaware bay. (4) The Susquehanna system, draining some of the southern-central part into the Chesapeake bay. (5) The Mississippi system, which, by means of the Allegheny river, drains the extreme southwestern part of the state. Chautauqua Lake drains into the Gulf of Mexico, but almost in sight from it is Lake Erie, which flows into the St. Lawrence. Along the Hudson and other large streams, special horticultural interests have developed. The broad Mohawk valley is one of the most fertile parts of the state, and it is the site of the hop and broom-corn industries. The shores of the central New York lakes are the homes of highly developed horticultural interests, particularly those of Keuka and Seneca. These central lakes, of which Cayuga, the largest, is 40 miles long and one to five miles wide, are deep bodies and have great influence in ameliorating



1483. County map of New York State.

the climate in their immediate neighborhood. The shores of Lakes Erie and Ontario conserve horticultural interests,—the former being famous for its grapes, the latter for its strawberries, peaches and apples. Because of its snug winters, there is rarely any starting of fruit-buds by "warm spells," and consequently little danger of loss from spring frosts. The fruit-growing suffers less from frost than it does in the southern states.

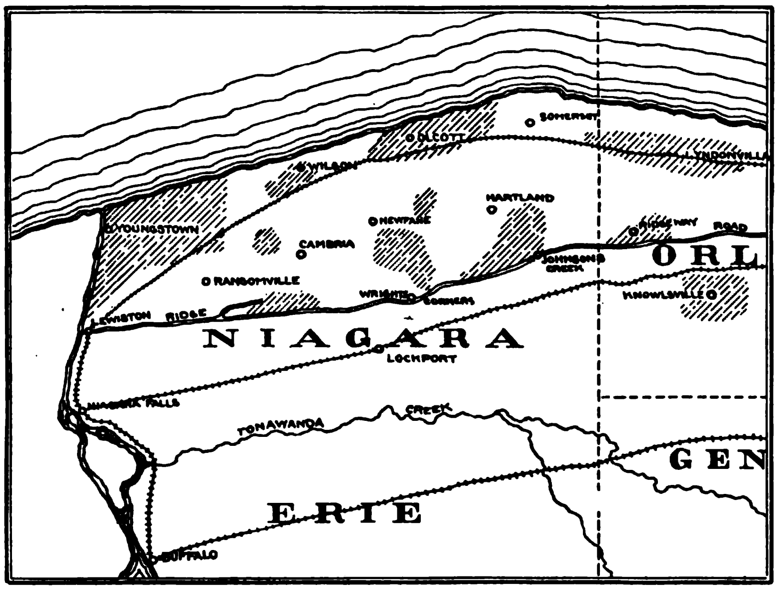
New York contains about 230,000 farms. Agriculturally, the most important industry in New York state (aside from general mixed farming) is dairying. The second industry is fruit-growing, and this seems to be extending more rapidly than the other. The leading fruit is the apple. Nearly all parts of the state grow apples easily, but the great commercial apple-growing regions are the counties of Wayne, Monroe, Orleans, Niagara, with important extensions in Ontario, Genesee and adjacent counties and in Columbia and other east-Hudson counties. A full crop of apples in New York is nearly or quite 7,000,000 barrels. Baldwin is the leading variety, with no varieties which occupy a close second place. Northern Spy, Rhode Island Greening, and American Golden Russet are important commercial varieties. Of late, Ben Davis has been widely planted, but it is probable that this variety will always hold a secondary place in the northeastern states. Until within the last decade, most New York apple orchards have been in sod; but, under the stimulus of rational horticultural teaching, 75 per cent of the orchards in the apple-growing counties are now under a most thorough system of clean tillage. Fig. 1485. Most of these orchards are sprayed. Crops have been heavy in recent years and prices have averaged good; as a result, the apple industry is in thriving condition. The most thorough business methods are employed in caring for the orchards and in disposing of the crop. A large part of the apple crop is exported, although there is a very large business in evaporated fruit.

The grape occupies second place in New York pomology. More than 50,000 acres is devoted to this industry, of which about half the area is in Chautauqua county, lying in a narrow strip against Lake Erie. The other special areas are the central lake region and the Hudson river valley. These three areas stand for three types of viticulture—early and special table grapes for near-by markets in the Hudson valley; staple varieties for wine and grape juice in parts of the lake region (particularly on Keuka lake); general-purpose varieties for distant markets in the Chautauqua region. In the lake region, Catawba is a leading variety. In Chautauqua, Concord far outstrips all others. A normal output of table grapes in New York is about 60,000 to 70,000 tons; of wine between 2,000,000 and 3,000,000 gallons. The grape areas lie close to the lakes or large rivers, thereby receiving the benefit of the ameliorated local climate.

New York is known also for its pears. The apple counties mentioned above, and Oswego, Onondaga, and Columbia counties are the leading pear areas. Bartlett is the staple variety, but Kieffer has risen to near the first place in recent years. The number of commercial varieties, however, is relatively large. The culture of dwarf pears is popular and has reached a high degree of perfection. Thrifty and productive orchards 40 and 50 years old stand in various parts of the state.

The plum is largely planted in western New York, in many varieties. In acreage, Lombard probably leads, but several other varieties excel in commercial importance. The Damsons are largely grown; also the German and Italian prunes (but the latter are not dried). The Japanese plums are now widely planted, and are giving general satisfaction. They are rarely injured by late spring frosts. The improved native plums are relatively little known.

Peaches are grown about all the central lakes and in the Hudson valley, but the only distinct natural peach



1484. Distribution of peach-growing in a part of western New York. The shaded parts show the chief peach-orchard areas in Niagara and Orleans counties.

region is near the Ontario shore west of Oswego. In the western half of the state, about 10,000 acres are devoted to peach-culture. Fig. 1484.

Apricots are grown with little trouble in the peach regions, and there are several commercial plantations.

Cherries are grown both for the fresh fruit and for canning—the former chiefly in the Hudson valley and the latter chiefly in western New York. The canning cherries are the sour type—chiefly English Morello and Montmorency. The large canning factory industry (some 25 factories in western New York) makes the sour cherry industry profitable.

Quinces are probably more largely grown than elsewhere in the Union.

The small fruit interests are very large, but there are no reliable statistics. In the northern counties of western New York, black raspberries are grown as a farm crop and the product is mostly evaporated. The annual output of dried raspberries five years ago was approximately 1500 tons, but the amount is now less. While the strawberry is an important crop in all parts of the state, it reaches its largest acreage in Oswego county (Fig. 1486), where about 1200 acres are devoted to it. This region supplies the late markets, producing annually about 2,000,000 quarts. In Oswego county there are about 250 acres of red raspberries, mostly Cuthbert. Cranberry-growing has attained some importance on Long Island.

Western New York has long been the center of the nursery business of North America. Of the 4,510 nurseries reported in the United States census of 1890, 530 were in New York. Illinois was second, with 434, and Ohio third, with 393. Not only is the number large, but the variety of stock grown is also significant. Rochester and Geneva are the chief nursery centers, although the stock which is sold in these centers is grown over a wide range of country. In acreage in 1890, New York leads with 24,840 acres, followed by Illinois with 17,812 acres, Ohio 16,790, Nebraska, 15,641, Missouri, 15,190. The total capital invested was nearly $12,250,000 in New York, as against $4,750,000 in Illinois.

In seed-farming, New York stood next to New Jersey, in 1890, in amount of capital invested,—$2,176,076.72 as against $2,333,066.68. In number of seed-farms, Connecticut had 85, New York 78, Tennessee 35, New Jersey 34. The principal seed-crops grown in New York are bush-bean, Brussels sprouts, cabbage, sweet corn, cucumber, kale, onion, pea, turnip, asparagus.

The trucking interests are very large because of the large population and the many means of transportation. The largest single geographical region is Long Island, which, because of its light soil, warm local climate, and accessible location, is one of the leading market-gardening regions of the New World. Long Island has an area of 1,700 square miles, of which the western third is largely devoted to trucking interests. Parts of the eastern end are also trucking areas, particularly for cabbage and cauliflower. Cabbage seed is extensively grown in this eastern extremity of the island.

The floricultural interests of New York state are large and growing. Of the 9,000 commercial florists' establishments that Galloway estimates for the United States, not less than 1,100 or 1,200 are in this state, with glass amounting to nearly 4,500,000 square feet. New York city is a market for a large geographical region. As early as 1885, John Thorpe estimated that 4,000,000 roses that were sent to the New York market by nine growers in one year did not constitute half the number sold in that market. The census of 1890 reports the total investment of New York in floricultural business to have been about $9,500,000 (although only 793 establishments are accounted for), as against upwards of 5,500,000 in Pennsylvania, the next heaviest state. The lower Hudson region is the center of the violet industry of the United States. Long Island grows quantities of bulbs.

Because the horticultural interests of New York are separated in more or less distinct geographical regions, there has never been a representative state horticultural society. The New York Horticultural Society was established in New York City in 1818, and it was probably the first distinctly horticultural organization in North America; but it was really a local society and it is long since extinct. Efforts have been made to revive it, or

1485. A New York apple orchard.

rather to organize a new society under the old name, the last effort being made the present year. In 1829, the Albany Horticultural Society was organized, but this also was short lived. The oldest society in the state is the Western New York Horticultural Society, with headquarters at Rochester. The preliminary organization of this society occurred at Rochester, February 27, 1855, under the name of The Fruit Grower's Society of Western New York, to comprise the counties west of Onondaga.

1486. An Oswego strawberry field.

The late John J. Thomas was the first President. This society, with its one big meeting each winter, is the greatest American organization of its particular type.

One of the earliest experiment stations in North America was organized at Ithaca in February, 1879, as the Cornell University Agricultural Experiment Station. In 1888 this institution was reorganized as a federal station, but previous to this time it had published three reports. The New York Agricultural Experiment Station, supported by the State and located at Geneva, was established in March, 1882. These two stations give considerable attention to horticultural matters, particularly the State Station at Geneva which is located in one of the best of horticultural regions. Each station now receives support from both the state and the federal treasury.

The Agricultural College of New York is a part of Cornell University at Ithaca. It is practically unique amongst agricultural educational institutions in giving courses of true university grade, and its postgraduate courses lead to the degree of Ph.D. Short course instruction of elementary character is also afforded, and the university is the center of a movement for the extension of agricultural knowledge amongst the people.

L. H. B.

NEW ZEALAND SPINACH. Fully treated under *Tetragonia*.

NICÁNDRA (Nicander wrote on plants about 150 A.D.). *Solanàceæ*. One Peruvian herb differing from Physalis chiefly in the 3–5-loculed ovary and fruit and in the larger and more showy fls. **N. physaloides,** Gaertn., known as Apple of Peru, is a strong spreading annual, 3–4 ft. high, grown for the showy blue fls. and odd fruits: glabrous: lvs. elliptic or elliptic-ovate, sinuate and toothed, narrowed into a prominent petiole: fls. solitary in the axils, on recurving pedicels, an inch or more across, shaped like a potato flower: fruit a thin-walled and nearly or quite dry berry, inclosed in an enlarged, strongly 5-winged calyx. B.M. 2458.—The Apple of Peru is an old-fashioned garden annual, now rarely seen. It has escaped from cultivation in some places in the U. S., and it is now widely distributed in the tropics. It is often confounded with the ground cherry and alkekengi, which are species of Physalis. Not advertised.

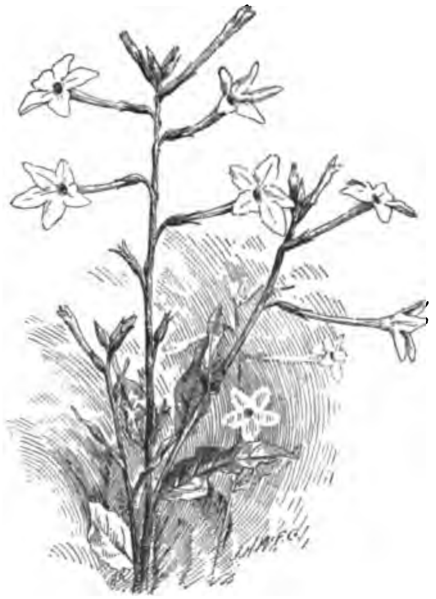
L. H. B.

NICOTIÀNA (John Nicot was French ambassador to Portugal in the sixteenth century, and was instrumental in spreading a knowledge of Tobacco). *Solanàceæ*. Fifty or more herbs, or one species shrubby, mostly of tropical America. The Nicotianas comprise several stately plants, valued for their rapid growth and large foliage. Other species produce showy flowers, and are popular flower-garden subjects. They are mostly viscid-pubescent herbs of strong odor, and possessing narcotic-poisonous properties. Lvs. alternate, never compound, entire or undulate, mostly sessile or nearly so by a tapering base: fls. long-tubular, mostly opening at night and most fragrant then, in terminal racemes, panicles or thyrses; calyx usually persisting and covering the fr.; corolla salverform or funnelform, the lobes usually plicate in the bud, the 5-lobed border nearly or quite regular; stamens 5, inserted on the tube, generally included, the filaments straight; style single, with a capitate stigma: fr. a capsule, normally 2-loculed, but usually splitting into 4 valves; seeds numerous and minute.

Nicotianas are of the easiest culture. They love a hot exposure, and loose, well-drained soil. They are all tender to frost. For subtropical effects, the seeds (by which they are usually propagated) should be started early under glass. The seeds are so small that they do not germinate well in the open unless the ground is fine and holds moisture near the surface. *N. alata* is the only species which is popularly known as a flower-garden plant, being grown everywhere under the name of *N. affinis*. Of the robust species used for subtropical bedding, *N. glauca*, *N. tomentosa* and forms of *N. Tabacum* are best.

L. H. B.

Nicotianas are tropical herbs requiring in northern latitudes a deep, loamy, rich soil and full sunlight. The soil should be especially rich in lime and potash, both of which may be supplied by the addition of wood ashes. Nicotianas will not grow well in very moist or poorly drained soils. In cool weather the seeds germinate slowly, so that when it may be desired to raise the plants outdoors in early spring the seeds should be "sprouted" before sowing by keeping them moist and warm until growth may be seen. The method generally pursued in northern tobacco-growing regions is to mix the seed, about April 1, with very fine rotted apple tree wood (apple wood is preferable to others, as it contains less tannin, which would be destructive to germinating seeds), and to place the mixture after moistening in a glass jar, and seal. The jar is then placed in a temperature of 80° to 90° until the seed is seen to be germinating, which should be in from four to six days. The seeds are then sown in frames covered with cloth or glass and rolled in with a light roller, or simply pressed in with a board. Another method of sprouting the seed is to spread it on a thin cloth stretched over a vessel of water placed where it will be continually warm. When very young, Nicotianas will endure severe frost, which property they lose with age, becoming quite sensitive to



1487. Nicotiana alata.

frost when mature. Nicotianas are well adapted for culture in pots or tubs, and are then fine plants for summer porch decoration.

F. W. Barclay.

A. *Fls. yellow or yellowish white: lvs. distinctly petioled.*

B. *Plant glabrous and glaucous, becoming woody (N. rustica is not to be sought here).*

glaùca, Grah. Becoming 20 ft. high and tree-like in its native place (Argentina), glabrous, glaucous-blue all over and sometimes developing purplish tints: lvs. large, ovate, sometimes subcordate, more or less repand, the petiole conspicuous: fls. in a loose panicle, tubular and constricted below the very short limb, curved, 1–2 in. long, greenish at first but becoming yellow, soft-pubescent on the outside. B.M. 2837.—Not uncommon in cult. for its striking glaucous-blue foliage and stately habit; also run wild in Texas and S. Calif. Usually does not bloom in the northern states. Easily grown from seeds.

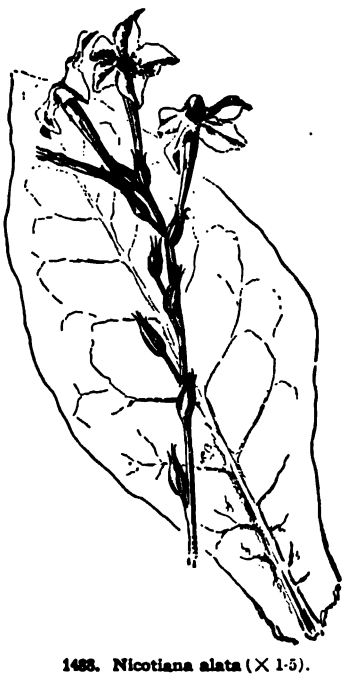
BB. *Plant pilose, herbaceous or half shrubby.*

wigandioìdes, Koch & Fint. Tall-growing, reaching 6 and 7 ft. high, with a straight central shaft and bearing very large and heavy foliage: lvs. ovate and pointed or sometimes acuminate, often undulate-margined but not toothed, hairy: fls. yellowish, short, in drooping panicles. Colombia.—A very striking plant, sometimes used for bold subtropical effects.

AA. *Fls. white, long-tubular: lvs. mostly not petioled and more or less clasping: annual and perennial herbs. In some of the following species the fls. are green or purplish on the outside.*

B. *Corolla-lobes acute.*

alàta, Link & Otto (*N. affinis*, Hort., under which name it is universally known in gardens). Figs. 1487, 1488. Slender but strong-growing, 2–3½ ft. tall, viscid-pubescent: lvs. lance-obovate or ovate-elliptic, becoming small and narrow above, clasping and sometimes decurrent. entire or remotely repand-dentate: fls. remote in a wand-like raceme, spreading, the very slender tube 5–6 in. long, the limb oblique and 2 in. or more across, the narrow-pointed lobes unequal. Braz. G.C. II. 16:141. Gn. 34, p. 520; 42, p. 126; 50, p. 212; 56, p. 384 Gng. 5:182. B.R. 19:1592 (as *N. Persica*).—A deservedly popular plant, blooming freely all the season until killed by frost. It is well to plant it in a place which is protected from strong winds. It is apparently perennial, but is treated as a tender or half-hardy annual. It self-sows, and often maintains itself from year to year in the Middle States and South. In the warmer parts, the roots live over winter with a little protection. Fall-sown seedlings make excellent pot-plants for the window. The fls. open at night-fall, but close in the daytime. At night they are very fragrant. During the last ten years the plant has become very popular.



1488. Nicotiana alata (× 1-5). Commonly known as *N. affinis*.

Var. **decúrrens** (*N. decurrens*, Hort.) is lower, branching near the base, very floriferous.

sylvéstris, Spegaz. Fig. 1489. Lvs. larger and better than in *N. alata*, rugose and veiny, more prominently undulate, the stem well furnished near the ground: fls. large, hanging in whorls or fascicles in a heavy large panicle, in shape like those of *N. alata* but the limb less oblique and the tube more swollen, and not closing in the morning or on cloudy days. Argentina. Gt. 47, p. 130. G.C. III. 26:357.—One of the novelties of 1899 and 1900.

longiflòra, Cav. Erect, 2–3 ft., slender, the prominent foliage radical: lvs. oval-lanceolate to lanceolate, prominently undulate, pointed: fls. 4 in. long, the tube green or purplish, but the limb (lobes about ½ in. long) white at least inside, borne in simple racemes. Argentina.—Little known in cult., being inferior to *N. alata*. The flowers open late in the day. Perennial, but annual in gardens and in northern countries.

BB. *Corolla-lobes obtuse or rounded.*

suavèolens, Lehm. (*N. undulàta*, Vent. *N. longiflòra*, var. *undulàta*, Voss). Variable: 1–2 ft., annual or biennial, usually viscid: lower lvs. long-stalked and ovate or spatulate, the upper ones narrow and sessile and sometimes clasping, all undulate-margined as a rule: fls. in loose terminal racemes, on slender pedicels, salver-shaped, the narrow cylindrical tube about 2 in. long, the circular limb 1 in. or less across, pure white (or greenish outside). Australia. B.M. 673. Gn. 21, p. 291.—The broad lobes usually overlap, so that the limb often appears as if entire. Sweet-scented at night. Plant pubescent or glabrous. Not rare in gardens. It is said that it will endure moderate shade.

noctiflòra, Hook. (*N. longiflòra*, var. *noctiflòra*, Voss). Very like the last, and perhaps a geographical form of it: lvs. lanceolate-undulate: fls. often purplish outside but white within, the spreading lobes notched or emarginate: plant very viscid. Argentina. B.M. 2785.—A night bloomer, like the last. There is a var. **albiflòra,** with pure white fls.

AAA. *Fls. distinctly colored (usually with shades of red), the tube relatively broad or even inflated: annual and perennial herbs.*

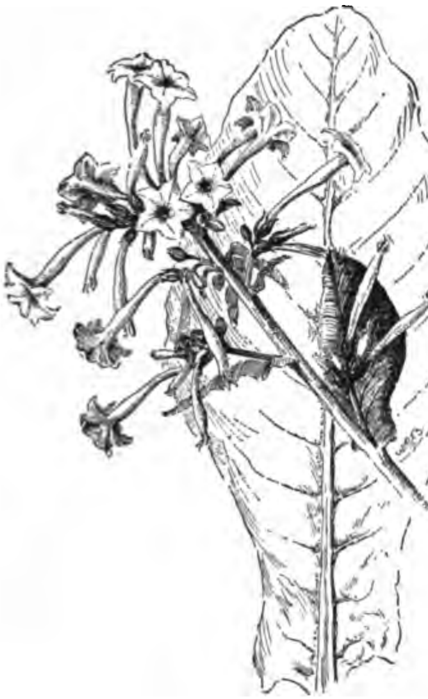
B. *Lvs. stalked.*

rústica, Linn., was cult. for Tobacco by the Indians and is run wild in many places, but its nativity is unknown (probably indigenous to the Old World, according to Gray): annual, usually not over 3 ft. tall, viscid-pubescent: lvs. large, ovate and obtuse: fls. yellowish or greenish, 1 in. or less long, the base narrow, tube thereafter inflated, orifice contracted, the lobes short and rounded. The fls. are open by day. Inflorescence paniculate.

BB. *Lvs. sessile and decurrent.*

Tabàcum, Linn. Tobacco. Tall, strong-growing striking plant, 3–5 ft., annual, usually glutinous: lvs. mostly ovate or ovate-lanceolate, acuminate-pointed: fls. 2 in. long, rose or purplish, in a large nearly naked panicle, the tube swollen upwards and the spreading lobes pointed. S. Amer.—Cult. from earliest times by the Indians, and occasionally run wild. Its commercial cultivation for Tobacco is an agricultural subject, and therefore is not discussed in this work. It is a striking plant in the garden. There are several forms cult. for ornament, those with large red fls. being most known. *N. grandiflorum*, *N. purpureum*, etc., are names given to these forms. The fls. are diurnal. See Fig. 1077, p. 757.

tomentòsa, Ruiz & Pav. (*N. colóssea*, André). Perennial, rarely blooming in the North, but easily propagated by cuttings and treated as a tender annual: 8 to 10 ft. and more, very stout and branchy, viscid-pubescent: lvs. obovate-oblong and acuminate, narrowed to clasping and decurrent base, 1–3 ft. long, pale and reticulate beneath: fls. short, the tube inflated at the top and slightly curved, pubescent, the lobes ovate and obtuse and nearly or quite equal, the color of the tube pale green and of the limb yellowish outside and pale rose within. Brazil. B.M. 7252. G.C. III. 9:83. Gng. 1:97. A.G. 11:117.—A most remarkable plant for large and rapid growth. Very useful in making subtropical effects. The plants came up in soil in which Brazilian orchids were shipped to France, and it began to attract general attention in France about 1889. It usually has reddish stems, thereby adding to the bold effect. Seeds should be started under glass, There is a var. **variegàta**, Hort., with mottled and margined foliage. R. H. 1893, p. 9. G.M. 37:61.



1489. Nicotiana sylvestris (× ¼).

N. acuminàta, Hook. Slender: lvs. petioled, broad-lanceolate, acuminate: fls. long-tubular, with small obtuse lobes, white. Argentina. B.M. 2919.—*N. fràgrans*, Hook. Three to 4 ft.: lvs. sessile, obovate or spatulate: fls. with very long, slender tubes (as in N. sylvestris) and a large spreading regular limb with emarginate lobes, white. New Caledonia. B.M. 4865.—*N. Lángsdorfii*, Schrank. Two to 3 ft., viscid: lvs. sessile, oval or ovate: fls. trumpet-shaped, the tube enlarging at the top, the limb flaring and nearly entire, yellowish green. S. Amer. B. M. 2221, 2555.—*N. paniculàta*, Linn., from S. Amer., is allied to N. Langsdorfii, but is smaller and all the lvs. are stalked.

Several Nicotianas are native to the Texan-Californian region. One, *N. quadriválvis*, Pursh, B.M. 1778, is native as far north as Oregon, and was cult. by the Indians for tobacco. L. H. B.

NICOTÙNIA is a name given by the undersigned to hybrids of Nicotiana and Petunia offered in 1893. They were originally described as follows: "The plants have slender, drooping or trailing tomentose green, red and purple stalks and leaves twice or three times as large as the Petunia; the flowers are handsome, white, pink, carmine or striped and borne in plenteous profusion. No seed is ever produced, but they are very readily multiplied by cuttings."

These plants have unfortunately vanished from cultivation. They were, of course, annuals. They were semi-trailing plants, the leaves covered with abundant short, woolly hairs. The cross was *Petunia hybrida*, var. *grandiflora* × *Nicotiana wigandioides*, var. *rubra*, the former probably being the seed parent. The singular thing about the cross was the fact that the root seemed in all cases to be paralyzed and very defective, though the tops in all the many hybrids produced grew with much vigor. The blooms were beautiful, and it is a pity that the plants were not grafted on tobacco roots.

LUTHER BURBANK.

NIDULÀRIUM (from Latin *nidus*, a nest). *Bromeliàceæ*. About 15 Brazilian epiphytes, by some referred to Karatas and other genera, but by Mez (DC. Monogr. Phaner. 9) kept distinct. The flowers are perfect, borne in simple or compound heads, the petals joined at the base and not ligulate (in all the typical species): anthers attached mostly on the back (in some related plants attached mostly at the base). Leaves strap-shaped, ovate or oval, in dense rosettes, the flowers mostly sessile, red, blue, or white. The inner leaves of the rosette, here called bract-leaves, are usually highly colored and constitute most of the merit of some species. Warmhouse plants, requiring the treatment of Billbergia, which see.

In the following account, the genus is held to comprise the species referred by Mez to Aregelia, having simple flower-clusters, whereas Nidularium proper has compound clusters.

A. *Flower-cluster simple* (*Aregelia*).

B. *Length of flower 1¼ in. or less.*

triste, Regel (*N. marmoràtum*, Hort., not Morr. *Karàtas tristis*, Baker. *Aregèlia tristis*, Mez). Lvs. 6–12, from 6–12 in. long and half as broad in the middle, green dappled with brown, somewhat scurfy beneath: flower purple: bract-lvs. narrow-linear: fr. oblong, white.

BB. *Length of flower 1½ in. or more.*

Morreniànum, Makoy (*Karàtas Morreniàna*, Ant. *Aregèlia Morreniàna*, Mez). Lvs. many in a dense rosette, with few very minute spines, not striped, densely scurfy beneath: fls. many, dark purple: bract-lvs. linear-lanceolate.

N. Carolinæ, Lem. (*N. Mèyendorfii*, Regel. *Karàtas Carolìnæ*, Ant. *Guzmània picta*, Hort. *Billbérgia Carolìnæ*, Beer. *B. òlens*, Hook.). Lvs. several to many, strap-shaped, rather thick, finely spiny-toothed, 12 in. long, bright green on both surfaces, the bract-lvs. bright red: fls. blue-purple, in a short head nestling in the bright leaf-cup. B.M. 5502. I.H. 7:245.

princeps, Morr. (*N. spectàbile*, Hort. *Karàtas princeps*, Baker. *K. Mèyendorfii*, Ant. *Aregèlia princeps*, Mez). Lvs. 15–20, about 10–12 in. long, broadest at the middle, firm, spiny-toothed, lightly glaucous: fls. numerous, violet-purple, surrounded by about 8–10 oval, bright red bract-lvs.

Binòti, Morr. (*N. Makoyànum*, Regel. *Karàtas Binòti*, Morr. *Aregèlia Binòti*, Mez). Lvs. 15–20, strong-spiny, scurfy and transversely banded on the back, the inner ones similar in color: fls. many, white. Not to be confounded with *Bromelia Binoti*.

AA. *Flower-cluster compound.*

B. *Petals joined below.*

C. *Flowers white.*

Innocéntii, Lem. (*Karàtas Innocéntii*, Ant.). Stemless and stoloniferous: lvs. about 20, in a dense rosette, strap-shaped, about 1 ft. long, broadest near the middle, with many small, spiny teeth, green but more or less tinted brown or red, the oval bract-lvs. bright red: fls. in a dense head, white. I. H. 9:329.—Named for the Marquis de St. Innocent, amateur, of Autun, France. There is a form with yellow-striped lvs. I. H. 41:5. This species is one of the best Nidulariums.

striàtum, Baker (*N. Makoyànum*, Morr., not Hort. *Karàtas neglécta*, Baker). Lvs. 8–12 in. long, strap-shaped, fine-toothed, prominently striped with central bands of white and shading to cream-color towards the margin, the body color deep green and not brown-tinted. G.C. III. 8:183 (desc.).—A good species.

cc. *Flowers blue or violet.*

Scheremetiéwii, Regel (*Karàtas Scheremetiéwii*, Ant.). Lvs. 10–15, in a short rosette, lanceolate, 10–18 in. long, with many small but conspicuous spiny teeth, rather firm, bright green above and pale green beneath, the bract-lvs. bright red and showy, the points recurving: fls. blue, in a small head.

fúlgens, Lem. (*N. pictum*, Hort.). Lvs. 15–20, in a dense rosette, strap-shaped, with large, strong teeth, mottled with green of different shades, paler and scurfy beneath, the bract-lvs. oval and scarlet: fls. blue.

bb. *Petals separate.*

Lindeni, Regel (*Æchmèa ebúrnea*, Baker. *Gusmània frāgrans*, Hort. *Canistrum Lindeni*, Mez). Lvs. about 20, in a dense rosette, tomentose, green-spotted, the bract-lvs. cream-white: fls. white or greenish.

Amazónicum, Lind. & André (*Karàtas Amazónica*, Baker. *Canistrum Amazónicum*, Mez. *Æchmèa Amazónica*, Hort.). Lvs. 15–20, 10–20 in. long, and rather wide at the middle, greenish brown above and light brown beneath, not spotted or scurfy, the bract-lvs. greenish brown: fls. white, with a green tube, in a dense head.

N. Chantrièri, André, is a hybrid of N. Innocentii and N. fulgens, with very brilliant red bract-leaves, obtained by Chantrier Frères, France. R.H. 1895:452. L. H. B.

NIEREMBÉRGIA (for John E. Nieremberg [1590–1563], a Spanish Jesuit and first professor of natural history at Madrid). *Solanàceæ.* Cup-Flower. About 24 species of hardy perennial herbs from tropical and subtropical America, allied to Petunia and characterized by the long and very slender tube of the corolla. The species in cultivation are valued chiefly for the open border or for pot-plants, and are mostly of prostrate habit, with showy fls. borne freely through the summer and autumn. Stem decumbent or creeping, rarely suberect, diffusely branched, the branches usually slender and nearly glabrous: lvs. alternate, scattered, entire: fls. borne singly on the tips of young shoots, mostly white with a purple center; calyx 5-parted, tubular or bell-shaped; sepals spreading; tube of corolla long, slender, attenuated below, abruptly expanded above into a broad bell-shaped, saucer-shaped or funnel-shaped limb, which has 5 broad, obtuse lobes.

Several species of Nierembergia have distinct value for certain purposes. *N. gracilis* makes an excellent pot or basket plant, and is also popular for the border. *N. frutescens* does finely in the open, but is more desirable as a pot-plant. *N. rivularis* is perhaps the most desirable species of the group, and is adapted to a wide range of conditions. It thrives best in a moist soil with a half-shaded exposure, but often makes fine patches on a dry bank, or even in the rockery. Both *N. gracilis* and *N. frutescens* love a loose, rather moist soil, but are not impatient of dryness. These three species endure winters without protection in the latitude of N. Y.

Nierembergias are propagated chiefly by cuttings taken in the fall, or by seeds. *N. rivularis* is most readily increased by dividing the creeping stem where it has rooted at the nodes.

A. *Stem prostrate or creeping: branches ascending.*

B. *Fls. creamy white, sometimes slightly tinted with rose or blue.*

rivulàris, Miers. White-Cup. Whole plant glabrous: stem slender, creeping, rooting freely at the nodes, forming a dense mat, the branches seldom rising over 6 in. high: lvs. oblong to oblong-spatulate, obtuse membranaceous, variable in size, with a long, slender petiole: fls. sessile or short-peduncled; calyx cylindrical, the lobes oblong-lanceolate, slightly spreading: corolla-limb broadly bell-shaped, 1–2 in. broad; throat golden yellow. La Platte river, S. A. B.M. 5608. J.H. III. 31:311. Gn. 23, p. 188; 25, p. 145.—A very adaptable and desirable species for a stream bank, dry border or alpine garden. The fls. are large and beautiful. It is difficult to eradicate after once established, as small pieces of the stem will take root and grow.

bb. *Fls. white, with purple center.*

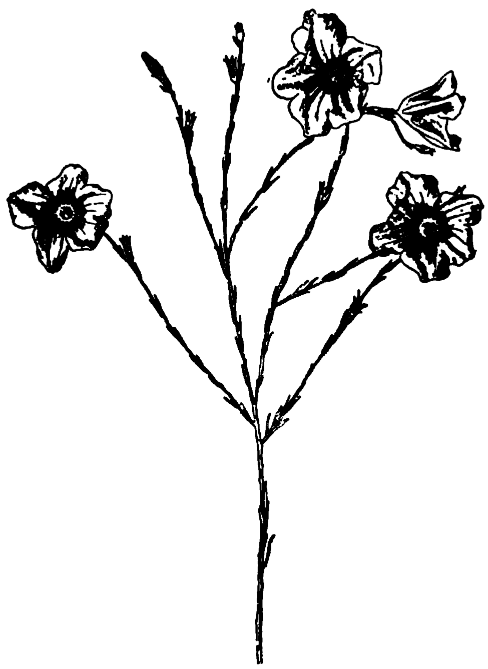
grácilis, Hook. Fig. 1490. Branches very slender, ascending 6–8 in., slightly downy: lvs. scarcely ½in. long, linear or slightly spatulate, those on the younger branches somewhat hairy: limb of corolla spreading, convex, white tinged and veined with purple towards the center, throat yellow. Argentine Republic, S. A. B.M. 3108.—A charming little plant for the hanging basket. A garden var., **Crozyàna**, has fls. tinted with lilac and appears to be more floriferous than the type. F.S. 14:1410.

bbb. *Fls. pale lilac.*

Vèitchii, Berkeley. Stem 8–12 in. long, with slender, glabrous or slightly pubescent branches: lvs. ½–1 in. long, short-petioled or sessile, the upper linear, the lower broadly spatulate: calyx-lobes linear-oblong, recurved: corolla-tube ½–¾ in. long, white, the limb broadly bell-shaped. Trop. America. B.M. 5599. F. 1872, p. 141.

AA. *Stem nearly erect.*

frutéscens, Dur. Tall Cup-Flower. Stem 1–3 ft. high, much branched, shrubby: lvs. scattered, linear: fls. about 1 in. broad, the limb saucer-shaped, white tinted with lilac or blue; throat yellow; handsome. Chile.—The fls. resemble *N. gracilis* in color, but are much larger. Valuable in the greenhouse or for the border. As a pot-plant it makes a fine bush and bears fls. almost continuously. It can be used as a bedding plant with excellent results if started under glass and transplanted. A garden form, var. **grandiflòra** (*N. grandiflòra*, Hort.), has somewhat larger fls. than the type. S. W. Fletcher.



1490. Nierembergia gracilis (× ½).

NIGÉLLA (diminutive of *niger*, black; referring to the color of the seeds). *Ranunculàceæ.* Love-in-a-Mist. Devil-in-a-Bush. Fennel Flower. Hardy annuals with erect stems and finely divided alternate lvs.: fls. showy, white, blue or yellow; sepals 5, regular, petal-like, deciduous; petals 5, with hollow claws, notched or 2-lobed; carpels 3–10, fusing at the base into one cavity, cells opening at the top when mature: seeds many, black and hard. There are about 12 species, including Garidella; mostly natives of the Mediterranean region. The following 2 are only species now used in America. They require little care. The seed should be sown in the open border in good soil any time after the middle of March, and the seedlings thinned, if necessary, to a distance of about 8 in. They seldom succeed well if transplanted. If the seeds be sown in early autumn the plants may withstand the winter and be ready to flower earlier the next summer. By planting at different seasons the plants may be continued in beauty nearly throughout the summer. The seeds of *N. sativa*, Linn., or black cummin, are sometimes used as seasoning in the Old World.

1491. Love-in-a-Mist—Nigella Damascena (X ⅓)

Damascèna, Linn. Fig. 1491. Height 1–2 ft.: lvs. bright green, very finely cut: fls. white or blue, large: involucre very dense and fine: styles erect in the fr., nearly as long as the capsules: fr. not divergent at top. Summer. S. Eu. B.M. 22. Gn. 37, p. 130.—Var. **nàna,** Hort. A dwarf form with very large fls.

Hispánica, Linn. Lvs. much divided, but less so than in the preceding: fls. deeper blue than the last, with deep red stamens; involucre absent; styles rather spreading: fr. divergent at top. July. Spain and N. Africa. B.M. 1265. Gn. 37:739.—Var. **Fontanesiàna,** Hort. (*N. Fontanesiàna*, Hort.). Much like the type, but said to flower two weeks earlier.

K. C. Davis.

NIGGER TOE. Nuts of *Bertholletia*.

NIGHT-BLOOMING CEREUS. See *Cereus*.

NIGHTSHADE. *Solanum nigrum*. **Deadly N.,** *Atropa Belladonna*. **Enchanter's N.,** *Circæa*. **Three-leaved N.,** *Trillium*.

NINE-BARK. *Physocarpus opulifolia*.

NIPHÆA (Greek, *niphos*, snow; alluding to the white color of the fls., which is rare in this family). *Gesneràceæ*. *N. oblonga* is a plant something like a Gloxinia, but instead of a large spotted throat the flowers have so small a tube as to appear almost 5-petaled. Niphæas are tropical American stemless or dwarf herbs, with heart-shaped, coarsely serrate, hairy lvs. and clusters of about a dozen fls. an inch or so across, borne singly on reddish stalks about 2 in. high. For general cult. they are inferior to Gloxinia and Achimenes, but they are desirable for botanical collections as being one of the most distinct types of the gesneraceous family. They have a creeping root, and no tubers: lvs. soft, wrinkled, petiolate, opposite: corolla nearly wheel-shaped; disk absent; filaments shorter than the anthers, straight; anthers erect, free, the cells facing inward, parallel, confluent at the apex: glands none.

"Like many other plants from Guatemala," says Lindley in B.R. 28:5, speaking of *N. oblonga*, "it seems to require a temperature between that of a greenhouse and of a stove. In its general habits it resembles *Achimenes rosea*. It flowers in the autumn and winter, after which the stems die off, and the plant remains in a dormant state until the following season. When in this state it ought of course to be kept perfectly dry, on a light, warm shelf, and then when the season of rest is past, which will be indicated by the young stems making their appearance, it may be repotted and liberally supplied with water. It forms a great number of curious imbricated scaly buds, both on the surface and under ground, by which it may easily be multiplied in the same manner as Achimenes; it also strikes readily by cuttings. Any rich light soil will do for its cultivation."

oblónga, Lindl. Lvs. heart-shaped or perhaps somewhat oblong, more or less whorled: fls. drooping: corolla about 1⅛ in. across; lobes roundish, concave at first, then revolute. Guatemala. B.R. 28:5.

NIPHÓBOLUS Lingua, var. **corymbifera,** is a tough-leaved, crested fern, recommended by G. W. Oliver for window boxes. Oliver writes that this plant can be quickly increased by division of the stems, which grow near the surface of the soil. Niphobolus appears in a few trade catalogues. By English writers it is generally referred to Polypodium, but L. M. Underwood refers it to the genus Cyclophorus. The typical form of *Niphobolus Lingua* has the sori set in close rows of 4–6 each between the main veins. Rhizomes wide creeping, covered with rusty scales: stalks 3–6 in. long, firm, erect: lvs. entire, oblong-acuminate, 4–8 in. long, 1–4 in. wide, matted beneath with close, cottony, somewhat rusty down. It is a native of northern India and Japan. Its var. *corymbifera* has the lvs. much divided at the apex, forming a flattish, corymb-like cluster. N. N. Bruckner writes that var. **variegàta** is also cult. "It has light yellow lines about an eighth of an inch wide and three-fourths of an inch apart, running across the fronds at right angles to the midrib."

NITROGEN. The rôle of Nitrogen in horticulture is discussed under *Fertility*, *Fertilizers*, *Legumes* and *Manures*.

NOLÀNA (from *nola*, a little bell; referring to the shape of the corolla). *Convolvulàceæ*. About 18 species of prostrate annual herbs with showy blue fls., opening only in sunshine, all native to Chile and Peru. They are valued chiefly for covering poor or rocky soils. Stem often slightly angulate, usually spotted and streaked with purple above, much branched, the ends of the branches ascending several inches: lvs. solitary or in pairs, entire, usually fleshy, the lower long-petioled; the upper short-petioled, sessile or attenuated into a winged petiole: fls. borne singly in the axils of the lvs., mostly short-peduncled, commonly blue or purple, rarely white or rose; calyx 5-parted; corolla funnel-shaped or bell-shaped, entire, 5-angled or 5–10-lobed: ovaries 5 to many, 1–5-seeded, arranged in 1–2 series or clustered irregularly around the base of the style.

The characters by which several species of Nolana have been separated are not well defined. It is probable that *N. atriplicifolia*, *N. prostrata* and *N. paradoxa* should be considered as one species. The chief characters which have been used to distinguish them are the number of ovaries in each fl. and the number of seeds in each ovary; but these characters vary in different plants of these and other species of Nolana. *N. atriplicifolia* is commonly sold under the names of the other two. Consult Benth. and Hook., Genera Plantarum 2: 879. Latest monograph D.C. Prod. 13:9 (1852).

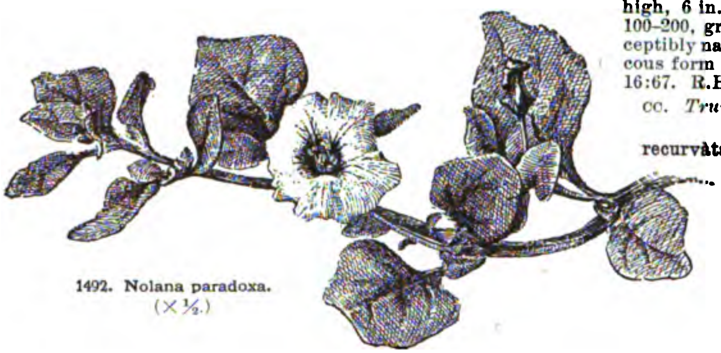
Nolanas grow readily from seeds sown in the open in May. For early blooming and for seed production they should be started under glass in March and transplanted in May. *N. atriplicifolia* is used with fine effect when planted in large patches in the border or on rocky hillsides. All of the species do well in pots.

They prefer a light soil and sunny situation. *N. atriplicifolia* is well suited for use in vases and baskets.

A. *Stem smooth or sparsely hairy.*

B. *Fls. large (1–2 in.), dark blue, not striped.*

paradóxa, Lindl. (*N. atriplicifòlia*, Hort. *N. grandiflòra*, Lehm.). Fig. 1492. Root-lvs. very long-petioled, ovate; stem-lvs. ovate, mostly sessile or with winged petiole, fleshy: sepals ovate-lanceolate; limb of corolla blue; throat white, inside of tube light yellow: ovaries commonly many, 1-seeded. Peru and Chile. B.R. 10:865, not B.M. 2604, which is *N. tenella.*—This is the most common species in cult. Var. **álba**, Hort., has white fls. Var. **violàcea** (*N. paradóxa*, var. *violàcea*) has violet fls. F.S. 13:1294.



1492. Nolana paradoxa. (×½.)

BB. *Fls. small (¾ in.), light blue, striped with dark purple.*

prostràta, Linn., not Hook. Throat of corolla marked with violet-purple veins; sepals triangular: ovaries commonly few, 2–4-seeded. Perhaps this should be united with the preceding. Chile and Peru. B.M. 731.

AA. *Stem densely hairy.*

B. *Stem-lvs. lanceolate, thick: plant hoary-pubescent.*

lanceolàta, Miers. Stem-lvs. mostly in pairs, 2–6 in. long, the base obliquely clasping or slightly decurrent on the outer side: fls. 1–2 in. broad, with a spreading, 5-lobed limb, each lobe deeply notched; limb of corolla blue, throat yellowish white. Chile. B.M. 5327.

BB. *Stem-lvs. ovate, membranaceous: plant viscid-hairy.*

tenélla, Lindl. Stem very slender: upper lvs. obtuse, with rounded base and winged petiole: peduncle long-hairy: fls. violet-blue, with a white throat; limb 5-lobed, each lobe tipped with a broad point. Chile and Peru. B. M. 2604 (erroneously as *N. paradoxa*, but poorly drawn, as no hairiness is indicated).—Not advertised in America.

S. W. Fletcher.

NOLÌNA (after P. C. Nolin, joint author of an essay on agriculture, Paris, 1755). *Liliàceæ.* Syn., *Beaucarnea.* Nolinas belong to the remarkable group of desert succulents in the lily family known as the Dracæna tribe, of which the Yucca is the best known example in our gardens. *Nolina recurvata*, which is perhaps the most desirable species, has a striking appearance. It has a fleshy trunk 5–6 ft. high, surmounted by a crown of 100 or more leaves, which are long, linear and gracefully recurved. The base of the trunk is swelled into a sort of tuber a foot or more thick, which sits on the ground like a huge onion. It has numerous very small, greenish white, 6-lobed fls., borne in panicles on flower-stalks several feet high. Nolinas are essentially Mexican plants. They are cult. in S. Calif., requiring similar treatment to Agave, Dasylirion and Yucca, but Ernest Braunton writes that they are not popular. In the East a few kinds are offered. They are desirable plants for fanciers who can house a collection of succulents.

Nolinas are nearest to Dasylirion, but their lvs. are unarmed, while those of the latter usually have hooked spines. Fls. polygamo-diœcious, the loose racemes forming a simple or compound panicle. Their stamens are included, while those of Dasylirion are exserted. For differences in fruit characters, see *Dasylirion.* The species of Nolina are imperfectly understood. In addition to those given below, *N. Beldingi* is offered. This was lately discovered in lower Calif. by T. S. Brandegee on mountains above Cape St. Lucas. It is arborescent and similar in habit to *N. longifolia*, but with glaucous lvs. (see note below). *Beaucarnea glauca* of the trade doubtless belongs in Nolina. Franceschi says it has a crown of stiff glaucous lvs. on a slender trunk with a bottle-shaped base.

A. *Lvs. 8–15 lines wide.*

B. *Habit of foliage recurved.*

C. *Trunk scarcely bulged at the base.*

longifòlia, Hemsl. (*Dasylírion longifòlium*, Zucc. *Beaucárnea longifòlia*, Baker). Trunk in cult. 4–6 ft. high, 6 in. thick below the crown of lvs.: lvs. 100–200, green, 4–6 ft. long, 9–15 lines wide, perceptibly narrowed from middle to apex. A glaucous form has been cult. G.C. II. 7:493, 567; III. 16:67. R.H. 1876, p. 454.

CC. *Trunk with a bulge at the base a foot or more thick.*

recurvàta, Hemsl. (*Beaucárnea recurvàta*, Lem.). Trunk in cult. 5–6 ft. high, 2–3 in. thick below the crown of lvs.: lvs. green, equally wide all the way, 8–9 lines wide at base. G.F. 9:95. G. C. 1870:1445. F.S. 18, p. 26. I.H. 8, Misc. p. 59.—Var. **intermèdia**, Hort., has lvs. which are less recurved and shorter. Var. **rùbra**, Hort., has the lvs. tinged red near the base. No varieties, however, are advertised.

BB. *Habit of foliage strict.*

C. *Width of lvs. 10–12 lines.*

Bigelovii, Wats. Trunk unknown: lvs. thick, flat, 3–4 ft. long, 10–12 lines wide above the base, with a red, horny entire margin.

CC. *Width of lvs. 5–6 lines.*

recurvàta, var. **stricta**, Lem. (*Pincenictítia glaùca*, Hort.). Lvs. shorter and narrower than typical *N. recurvata*, 2–3 ft. long, glaucous.

AA. *Lvs. 2 lines wide.*

Hartwegiàna, Hemsl. (*Dasylírion junceum*, Zucc.). Trunk unknown: lvs. 2 ft. long, with only 7–9 veins instead of about 50.

W. M.

N. Béldingi, Brandg. Aborescent, branching freely: trunk columnar, 1–1½ ft. in diam., 8–15 ft. high: branches short bearing numerous old and new leaves towards the ends: leaves glaucous, a yard or more long, ¾ in. wide, flat, thin, tapering to the point, serrulate on margins, about 50-nerved, weak and recurved: panicle compound, 6 ft. long or more: fruit emarginate: seeds round-ovate, not bursting the cells. Mountains of the cape region of Lower California. Apparently nearest N. Bigelovii, from which it differs in the thinner, more flaccid leaves, and the very much greater size.

T. S. Brandegee.

NONESUCH, or **Black Medick**, is *Medicago lupulina.* Nonesuch rarely means *Lychnis Chalcedonica.*

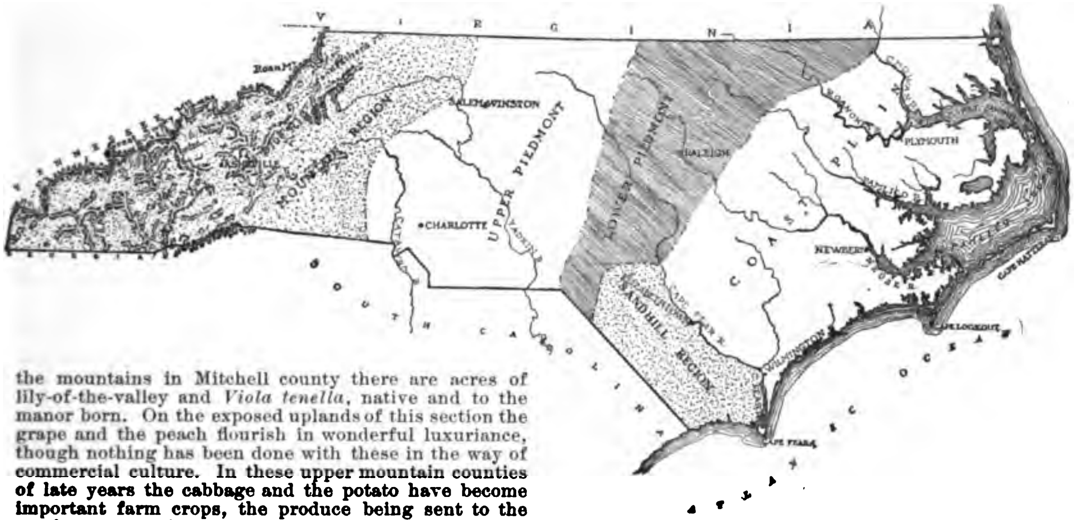
NOPÀLEA (from the Mexican name of the Cochineal Cactus). *Cactàceæ.* A genus of 4 or 5 species, often placed with the Opuntias, but differing from the latter in having leaves longer than the perianth, as well as in many minor details. Natives of the West Indies and Mexico. **N. coccinellifera**, Salm., an arborescent, flat-stemmed plant, with a somewhat cylindrical trunk 6–10 in. in diam., is widely grown in semi-tropical countries, but is rarely found in the U. S., and then only in the largest collections of Cacti. It is chiefly interesting in being one of the important food plants of the cochineal insect. B.M. 2741, 2742 (as *Cactus cochinellifer*).

J. W. Toumey.

NORFOLK ISLAND PINE. *Araucaria excelsa.*

NORTH CAROLINA, HORTICULTURE IN. Fig. 1493. Occupying the sunny slope eastward from the highest mountains east of the Mississippi, North Carolina has a greater variety in soil and climate than most other states; hence the horticultural capabilities are varied accordingly. In the region of high plateaus, ranges and valleys lying between the Blue Ridge and the Great Smokies, which mark the line of Tennessee, is a region dear to botanical collectors for its wonderful flora and of great interest to the horticulturist on account of its capacity for the production of fruit, especially of apples. Here the apple flourishes and produces the most wonderful and uniform crops under conditions of absolute neglect. What could be done here in the production of apples, with careful and intelligent culture and proper handling of the product, has been abundantly shown in the experience of the few who have attempted the culture. In this same region the French wine and table grapes have been flourishing for years, grafted on the native stocks. A complete failure of the apple crop has never been known in the mountains of North Carolina. On the eastern slope of the Blue Ridge are found the thermal belts. These belts are on the mountain slopes and are singularly free from the effects of early frosts in the autumn and late frosts in the spring; in fact, hoar frosts are almost unknown. The cold air settling down in the valleys pushes up the warm air and prevents frost above a certain line, thus insuring the safety of fruit above the frost line. These belts are peculiarly marked in Polk and Wilkes counties. In the high valley lands of Watauga and Ashe counties, lying 3,500 to 4,000 feet above the sea, are meadows where the finest of cranberries grow wild, and on the northern and western slopes of the mountains in Mitchell county there are acres of lily-of-the-valley and *Viola tenella*, native and to the manor born. On the exposed uplands of this section the grape and the peach flourish in wonderful luxuriance, though nothing has been done with these in the way of commercial culture. In these upper mountain counties of late years the cabbage and the potato have become important farm crops, the produce being sent to the southern coast cities in winter. The mountain section is in fact a vast fertile, but undeveloped, region horticulturally. Coming east of the great barrier of the Blue Ridge, we reach the wide rolling uplands of the Piedmont section, stretching its billowy swells eastward to the line of the coast plain, and varying in altitude from 1,500 feet above the sea-level near the mountains to about 350 where it drops off into the level sandy plain bordering the coast for 125 to 150 miles inland. Throughout this region cotton has held undisputed sway for many years except on the northern border, where tobacco has taken its place, and each has shut out much enterprise of a horticultural nature. Still, in some parts of the vast middle section there have been efforts to grow fruits, and in this section are the important nurseries of the state. Near the edge of this upland country, where the clay uplands break up into the rolling forests of long-leaf pine, and swelling sand-hills take the place of the red clay, it has been found that the dry soil and balmy winter climate were particularly favorable to those suffering from lung and throat troubles, and many people from the North, having found health there, remained to make homes on the sand-hills. And making homes, they wanted to grow fruit. Then it was discovered that the sand-hill country could be made to grow the finest of grapes, and now about the town of Southern Pines there are fully 1,000 acres devoted to the culture of grapes for shipment north. These are table grapes, mainly Niagaras and Delawares; they go north early in July, and the business has been a profitable one. Later it was found that the peach flourished on the sand-hills even better than the grape, and that there is seldom a total failure of the fruit. In the same neighborhood there are now at least 1,000 acres in peaches,—over 400 acres in one orchard. Shipments begin here about the first week in June, and in some seasons the Sneed peach is ready the last of May. A large area is being devoted to blackberries and strawberries also, as blackberries can be sent from here before strawberries are ripe in New York. Here, too, it is being found that the bulbs imported so largely for the use of florists for winter forcing, such as lilies, Roman hyacinths and narcissus, can be grown to great perfection. Experiments are being made with the Bermuda lily, and it is hoped that the bulbs can be produced here early enough for the early forcing, and that we may be able to grow healthy bulbs to take the place of the diseased Bermuda stock.

Horticulturally, the most interesting part of the state is the great level coast plain. Here the mellow soil, mild climate and abundant rainfall combine to make conditions favorable to great production, especially in the culture of small fruits. Along the line of the Atlantic Coast Line R. R. strawberries are grown by the thousand acres, and the culture has brought wealth to the growers. This, too, is the section where the greater part of the tuberose bulbs used by florists in this country and in England are produced on contract for the dealers in New York, Philadelphia and Chicago. Some attention is being paid, too, to the culture of caladiums, gladiolus and other bulbous and tuberous crops. The winter culture of lettuce in frames covered with cloth and glass has of late become a very important item in the gardener's list of crops in this section. It takes but little protection here to grow in winter lettuce as fine as that produced in heated houses in the North, and the rapid railroad communication makes the selling a sure matter. An industry that will grow here is the shipping north in winter of cut-flowers of narcissus and Roman hyacinths from frames and the open ground, and of gardenia flowers from the great bushes in the open ground in summer. Near the coast, as at Newbern, the market-garden business absorbs the entire attention of cultivators. From this section there are shipped of vegetables of all kinds in the spring and early summer over $4,000,000 worth annually, and the business is increasing steadily. With the coming of a dense population, the great swamps that now cover hundreds of square miles will be drained and more land of inexhaustible fertility will be added to this fertile region; here will be located the future bulb farms of the United States, and the dealers



1493. North Carolina, showing horticultural regions.

of New York and other northern cities will come here to make their contracts instead of going to France, Italy and Holland. Already some Holland growers are talking of coming to spy out the land, and the great development of the future in North Carolina will evidently be, so far as horticulture is concerned, in bulb culture.

W. F. Massey.

NORTH DAKOTA (Fig. 1494) lies between lat. 46° and 49° N. and long. 96° 25′ and 104° W. The special advantages of soil and climate for the production of grass and the small grains have given the state great agricultural prominence, but little has been done along horticultural lines. While it possesses undoubted possibilities along certain lines of fruit production, and in the growing of certain vegetables can hardly be excelled, yet these things have always been considered incidental and not to be classed with the leading soil industries. North Dakota settlers, for the most part, did not come from fruit regions, and in no case have they occupied the land with other intention than to raise stock and grain. At the same time, as population increases and homes become established, there is the natural tendency to protect these homes with trees, ornament them with shrubs and flowers, and furnish the tables with vegetables and fruit. Such is the present incentive to activity in horticulture, and its future status will be controlled by the following natural conditions:

Physical and Geologic Features.—Its distinctive regions are referred to as the Red river valley, the Turtle mountain country, the Devil's Lake region, the Mouse river country, the James river valley, the Missouri slope and the western range country, including the Bad Lands. The Red river valley is a level plain from 20 to 30 miles wide on the North Dakota side and extending across the state north and south, thus embracing an uninterrupted area of some 6,000 sq. miles, all level and of great fertility. This is preëminently the wheat belt of the state, and the character of the soil is such in both physical and chemical properties as to insure an excellent growth of such plants as are hardy and will mature within the season. The soil is a lacustrine deposit containing about 33 per cent of very fine sand, 55 per cent clay and silt, and 12 per cent organic matter and soluble salts. It is so rich in nitrogen and phosphoric acid as to be quite indifferent to fertilizers, even when applied to such garden vegetables as demand the most fertile soils. It rarely bakes under reasonable cultivation, is never lumpy and is very retentive of moisture. It is unusually well adapted to the cultivation of practically all vegetables, particularly celery and other plants requiring a deep, fine, easily worked soil.

This general type of soil is not confined to the Red river valley, but is the predominating surface soil for most of the state lying east of meridian 101 and of considerable tracts still further west. The subsoil in the Red river valley lying under three or four feet of very dark loam is uniformly a soft yellowish clay extending to a great depth. Much of the subsoil outside of the valley is largely made up of firmly compacted sand, with a small percentage of clay. Such lands are not so good as those having the clay subsoil, but with the good surface soil which they support they are capable of producing large yields in seasons not too dry. They are naturally not so well adapted to horticultural operations as are the lands having the clay subsoil.

Speaking in general, the soil lying west of the 100th parallel, also that of the Missouri slope, Turtle mountain and Mouse river countries is all well suited to vegetable and fruit culture, though partial failure may result from short seasons. This is especially true upon the level, rich soil of the Red river valley, which tends to prolong the growth of such plants as the grape and apple beyond the season in which they should mature. The more rolling surface of the land along the Missouri river affords opportunity to select favorable sites for fruit plantations, and there is doubtless some advantage in the soil itself. This is apparent in the cultivation of the grape, or such vegetables as the tomato, squash and melon. So far attempts to grow fruit on the lighter and more rolling soils, avoiding the extremes, has met with reasonable success. On the heavier soils and level lands success has been confined to the cultivation of such small fruits as the currant, gooseberry, raspberry and American plum and vegetables maturing not later than the earliest sorts of tomato or second early sweet corn. In connection with the fact that attempts at apple culture have generally been unsuccessful, it should be remembered that plants, as a rule, cannot make long jumps. The line of apple culture is gradually moving northwest, the successful varieties being those, like the Wealthy and Peerless, that have originated in the newer places. A region so far removed from the apple districts as North Dakota is must have the time and opportunity required to develop varieties of its own.

Climate and Rainfall.—Removed from all influence of large bodies of water, North Dakota has a dry climate subject to considerable extremes of temperature. The mean annual rainfall at Fargo for the years 1892 to 1899, inclusive, was 19.87 in., distributed by seasons as follows: Spring, 5.49 in.; summer, 10.02 in.; fall, 3.61 in.; winter, .51 in. Most of the precipitation is in spring and summer, when it is most needed. The average rainfall for June is 4.17 in. The fact that the great majority of agricultural lands in the state are absolutely flat, as near as land may be, and composed of a soil very retentive of moisture, makes what would otherwise be a light rainfall generally sufficient for ordinary needs. Further west than Fargo the rainfall gradually becomes less. For the twenty years between 1870 and 1890 the annual rainfall of the places named below was as follows: Bismarck, 18.90 in.; Fort Buford, 13.29 in.; Fort Totten, 17.78 in.; Pembina, 20.30 in.

The temperature is very uniform throughout the state, with the general difference that the range country in the western part has milder and more open winters, and the higher altitude, as well as latitude, of the northern tier of counties gives them a shorter and cooler summer, more inclined to frosts. It is only in that section that corn has not been considered, so far, as a possible crop.

At Fargo the mean temperature for the different months since 1892 is as follows:

Jan.	1.6	May	54.8	Sept.	59.1
Feb.	6.2	June	65.9	Oct.	42.3
March	10.7	July	68.7	Nov.	18.3
April	40.7	Aug.	66.2	Dec.	9.4

The following table of soil temperatures, comparing Fargo with Geneva, N. Y., is instructive and shows why, with the longer hours of daylight, vegetation develops rather more rapidly in North Dakota than in New York:

1896	*1 in.*	*3 in.*	*6 in.*	*9 in.*
June — Fargo	65.1	62.2	59.6	58.6
Geneva	67.3	66.5	65.5	65
July — Fargo	75.9	68.8	64.8	64
Geneva	76.6	72.4	69.3	67.8
Aug. — Fargo	76.5	68.1	67.3	63.6
Geneva	73.2	70.8	69.3	68.3
Sept.— Fargo	60.1	56.1	53.9	55.5
Geneva	64	63.1	62.1	61.2

The amount of soil moisture given in the following table, covering the years from 1892 to 1896, inclusive, shows that the comparatively high soil temperature is not due to extreme dryness. The samples were taken each week to a depth of 7 in. from a cultivated field in which wheat was grown a greater part of the time:

	Average for five years	
May	29.66	per cent
June	23.61	"
July	21.48	"
Aug.	20.19	"
Sept.	20.10	"
Oct.	19.78	"

As the water capacity is about 70 per cent and the land level, there is practically no loss from leaching or drainage. While these tables represent tests in a single locality, yet they would apply with exactness to 6,000 square miles and approximately to some 4,000 more.

Soil Fertility.—Samples of soil taken from different parts of the state from time to time and analyzed by Prof. E. F. Ladd, of the experiment station at Fargo, show that the nitrogen rarely falls below .2 per cent and in most instances reaches from .3 to .5 per cent, with an occasional sample yielding .7 per cent. The potash ranges from .25 to 1 per cent, the average sample giving about .5 per cent. The phosphates range from .15 to .25

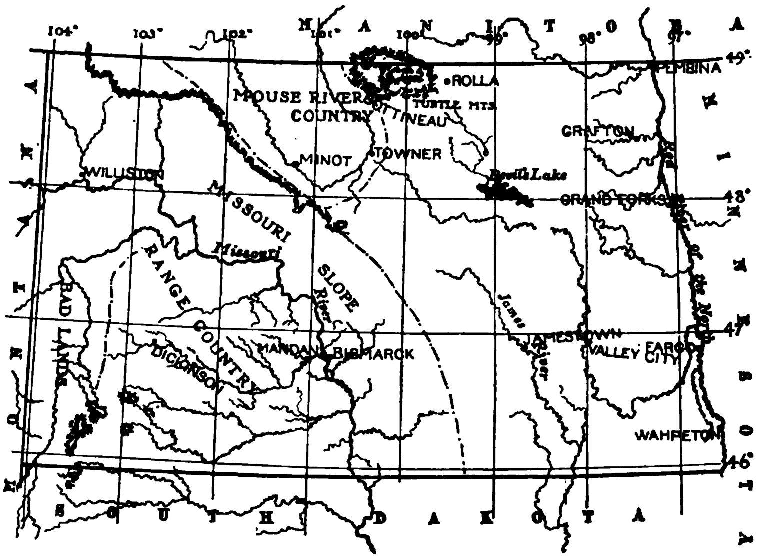
per cent on the average, with many samples giving as high as .30 per cent.

General Climatic Conditions.— The winters are cold but dry and agreeable. An occasional winter with too much sunshine kills young trees of the thin-barked varieties through the process of desiccation.

The springs are short, the warm days of summer coming very soon after winter and some time before the frost is out of the ground. In summer the days are long and sunny, with nights invariably cool. This condition gives the most perfect development of hardy vegetables, like the cabbage and celery, but retards the cucurbits and other semi-tropical species. At the same time, the fruit that does mature is of undoubtedly high quality and rich flavor, while the sugar beet and sweet corn give a very high sugar content.

The fall is usually dry and very pleasant, favorable to the maturing of woody plants, but rather liable to frosts. The ground freezes permanently about November 10.

Fruit-growing.—General settlement of what is now North Dakota did not begin till the building of the first railroad in 1873, and any effort to grow fruit has been made since that time. In 1874 Andrew McHench, of Fargo, made the first attempt at fruit-growing upon any extended scale. In that year he bought, at a nursery in Minneapolis, a car-load of young apple and crab trees of such varieties as the Wealthy, Hyslop, Transcendent, etc., and the year following planted 7,500 root-grafts of these and other varieties. Though Mr. McHench obtained some fruit and at different times grew trees that were models of thrift and fruitfulness, yet the venture was not a success.



1494. North Dakota, to show some of the physiographical features.

The varieties that successfully resisted the cold winters succumbed to the blight (*Bacillus amylovorus*) shortly after they came into bearing. Other attempts by different men made along the Red river valley since then have resulted similarly. In other sections of the state, particularly the Missouri slope, experiments in apple-growing have been more successful, this being due especially to less prevalence of blight. It is rather early to make the prophecy, but it seems reasonable that with irrigation the southwestern part of the state will, in time, become the apple region. Even without irrigation there are already indications of success.

The strawberry does not thrive in the strong sunshine and winds of North Dakota, and the blackberry finds the winters too cold, but gooseberries and currants grow and bear well anywhere and the hardy varieties of the raspberry thrive with winter protection. Grapes have never been thoroughly tried, but it is doubtful if their cultivation ever becomes general.

Vegetable Culture.—There are but few vegetables that cannot be produced abundantly and cheaply. This is particularly true of celery, onions, parsnips, etc., that require a deep, mellow soil. The season is long enough for the earlier sorts of corn, but tomatoes do not always ripen before frost. The ease with which the soil is worked and the fact that no fertilizer is required reduces the cost of production to the minimum.

The Flora.— So far as collected, the flora of North Dakota includes about 600 spermaphytes and vascular cryptogams running through 80 families. The grass family is by far the prevailing one, though the composites present the largest number of species. About 85 grasses have already been collected. Forests are found only along streams and in the broken areas south of Devil's Lake and in the Turtle and Pembina mountains. The number of species of trees is very limited. The more prominent of the trees as regards distribution and size are the bur oak and white elm in the eastern part of the state, and cottonwood and green ash in the western. The box elder, linden, aspen and hackberry are about the only other trees commonly found. The red cedar is found to some extent along the Little Missouri. In establishing tree plantations, the white ash, white willow, box elder and cottonwood are the trees usually employed. With reasonable cultivation it is not difficult to obtain a thrifty, rapid growth of these. In proportion to the trees the number of shrubs is large and, besides several of the commoner kinds of the Middle States, includes such striking species as *Shepherdia argentea* and *Elæagnus argentea*. *Rosa blanda* is found everywhere in great profusion, exhibiting a variety of exquisite colorings. Aside from the grasses the compositæ are most in evidence, and throughout the summer and fall the bright colors of Gaillardia, Rudbeckia, Echinacea, Liatris, sunflowers and asters make a profusion of gaiety. The legumes, too, are very common, the bright Petalostemons and Astragalus adding much to the showiness and richness of the landscape. The high nitrogen content of the soil is probably due in large measure to the prevalence of the Amorphas and vetches. The prairie fires that swept over the state annually for many hundred years have doubtless greatly modified the flora. As a result, the indigenous flora had very few annuals or plants with perennial tops, and these only in broken places, or along streams where the fires did not penetrate. In the western part of the state insufficient moisture would account for lack of forests. The remains of large trees in petrefactions and lignite deposits tell us that in cretaceous times the conifers found a most congenial home, while towards the tertiary period the angiosperms appeared.

Native Fruits.—While the wild fruits occupy an inconsiderable portion of the total area of the state, yet they are important in that they furnish thousands of families with their yearly supply of jellies and other fruit products. A list of the wild fruits in order of their importance would be about as follows: plum, buffalo berry (*Shepherdia argentea*), cherry (*Prunus demissa*), grape (*Vitis vulpina*) and Juneberry (*Amelanchier alnifolia*). The red raspberry and strawberry are also found sparingly. The only plum in the state is *P. Americana*, and this is found wherever other trees or shrubs grow. It is sometimes confined to thickets, as in the Middle States, or it may be scattered for miles along with the thorn and Juneberry. It is strongly variable in almost every character except fruitfulness, all forms being decidedly prolific. The shrub rarely grows more than 8 feet high. The fruit generally is of good quality, sweet and rich when ripe, but too soft to keep well. In a domestic way wild plum jelly is recognized as a staple article of superior merit, and though the plums are abundant in most seasons, yet they readily bring $2 per bushel in the local markets. The improved strains of this plum, like the DeSoto, Weaver and Aitkin, are being introduced and successfully cultivated. The buffalo berry is found from the James river westward, growing in thickets along streams and coulees. The bright red acid fruit is borne in the greatest profusion, but is rather difficult to gather, as it is sessile and thorns are plenty. It makes a clear jelly of reddish amber color and delicate flavor. The choke cherry of North Dakota is a puzzle botanically, and until further studied may as well pass for *P. demissa*. It is nearer to that, in superficial characters at least, than to *P. Virginiana*. The fruit is used to some extent for wine and marmalade and with other fruit in making jellies. *P. pumila* is widely scattered but not abundant, and the fruit is used but little. In the western part of the state the Juneberry produces abundantly a large fruit of rich flavor, but is more often used fresh from the bushes than in a culinary way. The rapid settling of the state has increased the demand for native fruits to such an extent that their value is being appreciated, and private ownership even in wild fruits is being insisted upon and recognized. This, of course, leads directly to the development and preservation of the better strains. CLARE BAILEY WALDRON.

NORTHWEST TERRITORY. See *Canada*.

NOTHOFÀGUS (Greek words, meaning *not a true beech*). *Cupulíferæ*. A genus of about 12 species, native of S. America, Australia and New Zealand, closely allied to Fagus, but chiefly distinguished by the fls., both staminate and pistillate ones being borne in 3's or solitary. The lvs. are generally small, often evergreen and either plicate in bud, like those of Fagus, or not. The wood of some species, especially that of *N. Dombeyi* and *N. procera*, in Chile, and of *N. Cunninghami*, in Australia, is much valued. They are not hardy in the North, and but little known in cultivation; they are probably not cult. in this country, though the following 4 species have been introduced into European gardens and have proved fairly hardy in England: *N. Antárctica*, Oerst., *N. oblìqua*, Oerst., *N. betuloìdes*, Oerst., *N. Cúnninghami*, Oerst., all trees or sometimes shrubby, with small, ovate or elliptic, crenate-dentate lvs., ½-1 in. long. The 2 first named are deciduous, the other 2 evergreen. They are perhaps oftener enumerated under Fagus, but besides the difference in the fls. they are strikingly different in habit, especially on account of their very small lvs., large only in *N. procera*. ALFRED REHDER.

NOTHOLÆ̀NA (Latin, *spurious, cloak;* from the rudimentary indusium). *Polypodiàceæ*. Often written *Nothochlæna*, but the above is Robert Brown's original orthography. A genus of mostly warm temperate rock-loving ferns, differing from Cheilanthes mainly in having no marginal indusium. Some of the species are coated with a golden or silvery wax-like powder. The following have been advertised only once by a dealer in native plants. See *Fern*.

A. *Fronds densely matted beneath.*

B. *Lvs. once pinnate.*

sinuàta, Kaulf. Lvs. 1-2 ft. long, 1-2 in. wide, growing on short stalks from thick, scaly rootstocks; pinnæ thick, entire or deeply pinnatifid; lower surface with rusty scales. Southwestern U. S. to Chile.

ferruginea, Hook. Lvs. 6-12 in. long, ½-1 in. wide, growing on wiry black stalks from thick, dark, scaly rootstalks; pinnæ deeply pinnatifid, with blunt lobes; texture thinner; lower surface densely matted with wool. Southwestern U. S. to West Indies and Chile.

BB. *Lvs. 3- to 4-pinnate.*

Néwberryi, D. C. Eaton. COTTON FERN. Lvs. 3-5 in. long, on stalks of the same length; ultimate segments ⅓-½ line wide, covered on both sides with slender, entangled hairs, which are more dense on the under surface. Calif.

Pàrryi, D. C. Eaton. LACE FERN. Lvs. 2-4 in. long, tripinnate, with crowded roundish obovate segments 1 line wide, which are densely covered above with entangled white hairs, beneath with a heavier pale brown wool. Utah to Calif.

AA. *Fronds with white or yellow powder beneath.*

cretàcea, Liebm. Rootstock short, with rigid scales: lvs. 1-2 in. each way, pentagonal on brownish stalks 2-7 in. long; ultimate segments oblong or triangular-oblong, crowded. Southern Calif. and Ariz.—Less handsome than the similar but larger and less divided *N. Hookeri* of Texas to Arizona.

cándida, Hook. Rootstock creeping: lvs. 3-6 in. long, ovate or deltoid-ovate, pinnate; lowest pinnæ with inferior pinnules elongated and again pinnatifid; upper surface green. Tex. and New Mex.

AAA. *Fronds naked below.*

ténera, Gillies. Lvs. 3-4 in. long, ovate-pyramidal, 2-3-pinnate; pinnæ distant, with ovate or subcordate, smooth, naked segments. S. Utah and Calif. to Bolivia. —Very rare. L. M. UNDERWOOD.

NOTHÓSCORDUM (Greek, *false garlic*). *Liliàceæ*. About 10 species of herbs having an onion-like bulb and closely related to Allium. Most of the species are found in tropical S. Amer., 1 in China and 1 in the U. S., ranging from Va. to Ind., Neb. and southward, in open woodlands and prairies. The bulb is without the onion odor and taste: scape 6-12 in. high: lvs. linear, basal, 6-12 in. long: fls. yellow or white, in an umbel: capsule oblong-obovate, somewhat lobed, obtuse: style obscurely jointed: ovary 3-loculed; ovules several in each locule.

striàtum, Kunth. YELLOW FALSE GARLIC. STREAK-LEAVED GARLIC. Bulb globular, 1 in. through, sometimes bearing bulblets at base: scape 1 ft. or less high: lvs. 7-8 in. high, 1-2 lines broad: fls. white, 6-7 in an umbel on slender pedicels, the segments narrowly oblong, 4-6 lines long: ovules 4-7 in each cell. Early spring. Va., west. B.B. 1:415.—Hardy. Procurable from dealers in native plants. M. B. COULSTON.

NOVA SCOTIA. See *Canada*.

NÙPHAR (from the Arabic). *Nymphæàceæ*. SPATTER-DOCK. YELLOW POND LILY. Six or eight aquatic plants of the north temperate zone, with stout rootstocks creeping in the mud, and large, cordate-ovate or sagittate lvs., some of which are floating and others either floating or standing erect above the water: fls. usually standing above the water, yellow or purplish, single on the scapes, the sepals 5 or 6 or more and constituting the showy part of the flower; petals numerous, small and usually simulating stamens, the latter numerous and short: ovary short and globular-ovoid, with 8-24 stigmas forming rays on its top: fr. a small, emersed capsule. The largest part of the Nuphars are North American. They grow in stagnant pools or on the margins of slow-running mud-bottom streams. Although several species have been offered by dealers, most of them have small value for the cultivator, although the foliage effects of *N. advena* may be striking. For culture, see *Nymphæa* and *Aquatics*. By some the Linnæan Nymphæa is used for this genus, and Castalia is used for the true water lilies. See *Nymphæa*.

A. *Lvs. mostly cordate-ovate: northern.*

B. *Plants strong and large.*

ádvena, Smith. COMMON SPATTER-DOCK. Fig. 1495. Lvs. large (about 1 ft. long), varying from cordate-ovate to cordate-oblong, thick, with a deep and mostly open basal sinus, the lower surface often pubescent; submerged lvs. usually wanting: fls. 2-3 in. across, more or less globular (not wide-opening), yellow or purple tinged, the petals fleshy and truncate, the sepals 6: stigma with 12-24 rays. N. Brunswick to Fla. and west. Mn. 1:17. G.C. II. 20:557.

rubrodíscum, Morong. Lvs. somewhat smaller; submerged lvs. usually present: fls. 1-1½ in. across, yellow, with 5 or 6 sepals, the stigmatic disk bright red and 9-12-rayed, the petals spatulate and fleshy. Penn. to Mich., and north.

polysèpalum, Engelm. Larger than *N. advena*, the lvs. three-fourths as broad as long, erect in shallow water and floating in deep water: fls. 4–5 in. across, yellow, the sepals 8–12, and the petals 12–18 and broad. N. Calif., northward and east to the Rockies.

1495. Nuphar advena (× ⅛).

lùteum, Sibth. & Smith. EUROPEAN YELLOW LILY. Lvs. cordate-ovate, floating or rising little above the water: fls. yellow, somewhat fragrant, smaller than those of *N. advena*, the sepals 5, and the petals very numerous: stigma 10–30-rayed. Europe.

BB. *Plant slender, often delicate.*

minimum, Smith (*N. pùmilum*, DC.). Slender: lvs. small, oblong, with a deep sinus and spreading lobes: fls. 1 in. or less across, yellow: stigmas 8–12, prominently indented. Eu.—By Bentham considered to be a form of *N. luteum*.

Kalmiànum, R. Br. (*N. lùteum* of American authors, at least in part). Slender, with prominent submerged orbicular, lettuce-like lvs., and the emersed ones floating, and only 3 or 4 in. long: fl. 1 in. or less across, yellow, with 5 sepals, and thin spatulate petals: stigmas 6–7. N. Y., west and south.—A very interesting plant.

AA. *Lvs. long-sagittate or narrow-oblong: southern.*

sagittæfòlium, Pursh. Rather stout: emersed lvs. floating, about 1 ft. long and 2–3 in. wide: submerged lvs. similar in shape, numerous: fls. 1 in. across, yellow, the sepals 5, the petals spatulate: stigmas 11–15. Southern Indiana and Illinois southward. L. H. B.

NURSERY: in horticulture, an establishment for the rearing of plants. Properly, a nursery exists for the rearing of any kind of plant, but in America the word is restricted to an establishment devoted to the growing of hardy, more particularly woody plants. This is because of the early and great development of orcharding and tree planting and the relative infrequency of glass structures.

In North America the nursery business, as we now know it, is practically an institution of the present century, although there were nurseries more than a century ago (see Vol. II, p. 766). As early as 1768, according to J. H. Hale, the New York Society for Promotion of Arts awarded Thomas Young a premium of £10 for the largest number of apple trees, the number being 27,123. But the large trading nursery developed simultaneously with the great orchard planting industry which began in western New York and extended westward, and, since the civil war, to the southward.

The only available statistics covering the general range of the United States nursery business are those published in Bulletin 109 of the Eleventh Census (figures for 1890), by J. H. Hale. The census enumerated the items of 4,510 nurseries, occupying 172,806 acres and representing a valuation of $41,978,835.80. The total capital invested was about $52,500,000. These establishments employed 45,657 men, 2,279 women, and 14,200 animals. The total number of plants and trees was 3,386,858,778, which figure does not include unenumerated plants on 1,477 acres of nursery grounds. Of this enormous total, fruit trees comprised 518,016,612 plants, and grape vines and small fruits 685,603,396. Apple trees alone, the highest figure given for a single species, numbered 240,570,666. It is safe to assume that each plant in this uncountable number was the subject of thought and solicitude on the part of the propagator; yet it is probable that not one in a hundred has lived to bring satisfactory reward to the buyer. It has been estimated that the apple trees now standing in orchards in the United States are 100,000,000, or less than half the number growing in the nurseries in 1890. The elements of loss are many, but the greater part of the failures occur after the stock has passed to the hands of the final purchaser.

The largest nursery center of North America, considering the number of persons engaged and the variety of stock grown, is western New York. The headquarters of this industry is Rochester. See *New York*. Nearly one-ninth of all the nurseries enumerated in 1890 were in New York state, and these establishments employed a capital of over $12,000,000. Very extensive nursery enterprises are now established in many other parts of the country, and it is probable that the center of the nursery business will move westward.

In America, nursery stock is grown on a large scale. This is particularly true of fruit trees. These trees are to be set in wide and open orchards, and the nursery practices are therefore very unlike those which obtain in Europe. In the latter country, for example, fruit trees are trained in the nursery row to assume definite shapes. Some are trained for standards,—to grow to one straight, bare trunk. Others are trained for bush specimens, some for growing on walls and espaliers, some with round heads, some with conical heads, and the like. It is the pride of the American nurseryman, however, that his rows shall be perfectly even and uniform. Any break in this uniformity is considered to be a blemish. If every tree could be a duplicate of every other, his ideal would be attained. Ordinarily, fruit trees are trained to single stems, the top starting at two or three feet from the ground. All fruit trees are budded or grafted. In the older parts of the country, budding is much preferred. In early days, root-grafting the apple was a common practice in the eastern states; but it has gradually given way to budding and thereby a top is supplied with one whole strong root. In the western states, however, root-grafting is still popular, partly because more than one tree may be made from an individual root, and partly because it allows the operator to use a long cion and to put the foster root far below the surface, thereby allowing the cion to send out its own roots and causing the tree to become own-rooted and to have a known hardiness.

There are many diseases and difficulties in the growing of all kinds of nursery stock. The most widespread and fundamental difficulty, however, is the inability to grow many crops of trees on the same land with good results. In fact, in the case of fruit trees it is usually considered that land which has been "treed" is therefore unfit for the growing of other fruit stock until it shall have rested in clover or other crops for a period of five years or more. Ornamental stock is often grown continuously on the same land with good results, even when the same species is grown. This is largely due to the fact that ornamental stock is sold by its size and not by its age, and therefore rapidity of growth is not so important as it is in the case of fruit trees. It has been supposed that this necessity of rotation is due to the exhaustion of certain plant-food elements from the soil. It has been found by careful experiments, however, that such is not the case. The chief difficulty seems to be a physical one. Lands which are devoted to nursery stock for one crop, which is from two to five years, becomes void of humus, and the digging of the stock when the land is wet or unfit to be worked tends to impair the physical character of the soil. Experiments have shown that commercial fertilizers will not always reclaim lands which have been treed, whereas barn manures and green crops may go very far towards revitalizing them. As a result of inability to grow vigorous stock on treed land, a large part of the nursery stock of the country, particularly fruit trees, is grown on rented land. On the nurseryman's central grounds a variety of stock may be grown, chiefly ornamentals, but the larger part of the commercial fruit stock is farmed out to persons who are willing to rent their land for this purpose and who will give the requisite attention to the growing trees.

1496. View in an American apple-tree nursery.

The nursery interests of this country are represented in a strong organization known as the American Association of Nurserymen, which holds a movable annual meeting in June and publishes a report. There are also societies representing geographical regions. At the present time, there is one periodical devoted to the nursery business, "The Practical Nurseryman," published monthly at Rochester, N. Y. The American current book writings devoted specifically to the business are Fuller's "Propagation of Plants" and Bailey's "Nursery-Book." L. H. B.

NUT in common language usage is any hard-shelled fruit which will keep for a more or less indefinite time without special efforts at preservation. In a botanical sense, a Nut is a hard and dry indehiscent 1-seeded fruit in which one or more ovules have been suppressed by abortion. In this sense, walnuts, hickory-nuts, acorns and cocoanuts are Nuts, but almonds, peanuts and Brazil-nuts are not. L. H. B.

NUT, AUSTRALIAN. *Macadamia ternifolia.*

NUT, CHILEAN. *Gevuina Avellana.*

NUT-CULTURE. From the earliest times nuts have been used as an article of food in North America. The prehistoric tribes left evidences of their use in the specimens which were buried with their remains. When the white settlers came they found several kinds of nuts growing wild and bearing abundantly, and thought to introduce the cultivated nuts of Europe along with fruits and farm crops that seemed to flourish in the virgin soil. But little success seemed to attend their early efforts, largely because of the unsuitability of the varieties tested. The sweet almond and the hazels were found to be of this character, and the few experiments with the European walnut and chestnut, where they did succeed, were not followed up by extensive plantings for many years. Nor were any of the native nuts brought under cultivation until very recently. Now there are many orchards and groves of both foreign and native nuts, some of which are already yielding profitable crops.

THE ALMOND (*Prunus Amygdalus*).—Among the first nuts to be tested were the cultivated almonds. All the experiments up to the present day lead to the conclusion that the choice varieties are not suited to any section east of the Rocky mountains, except, perhaps, in southwestern Texas and New Mexico. The close relationship to the peach would cause us to expect that it would succeed wherever that fruit does; but the trees of the choice varieties are too tender to endure any but very mild climates, and the fruit-buds are still more tender. The chief failing, however, is the habit of very early blooming, which causes the crop to be cut off by spring frosts, except in peculiarly favorable localities. There are differences in the ability of the varieties to endure cold and in time of blooming, even where they are counted a success. Not until seedlings were grown and tested, from which selections were made of suitable kinds, did the growing of this nut prove profitable.

Regions and Methods of Culture.—At the present time the culture of the almond is confined chiefly to California, and to some extent in Oregon, Utah, Idaho, Arizona and New Mexico. Fair crops of almonds of the highest quality in all respects are grown there. There are single orchards in California of hundreds of acres in extent. The crop of 1899, in that state, was estimated to be about 50 car-loads of 20,000 pounds each. It is thought that the production of new seedlings will still further overcome the weak points already mentioned, and materially extend the culture of really choice varieties. The methods of planting and cultivation of the soil are about the same as for the peach. Twenty feet is a good distance apart for the trees in rich soil. Unlike the proper treatment for peach trees, the almond tree should have but little pruning, owing to a different habit of the fruiting branches. See also *Almond.*

THE WALNUTS.—*American Walnuts.*—The kernels of all species of the walnut family are liked because of their rich and delicious flavor; but some of them are so small and difficult to get out of the shell that they are of little or no commercial value. Our native black walnut, *Juglans nigra*, and butternut, *J. cinerea*, are of this character. At present there are very few trees of either species that are grown for their nuts; but there are some prospects of improvement in this direction.

Asiatic Species.—Within the last 25 years there have been introduced from Japan two new species of walnuts, *J. Seiboldiana* and *J. cordiformis*, and from Manchuria one, *J. Mandshurica*. These make beautiful and stately trees, but the nuts of all but *J. cordiformis* have too thick shells to be of much value. See *Juglans.*

Persian Species.—The Persian walnut, *J. regia*, which has long been called English walnut and by several other titles, has been cultivated for many centuries for its thin-shelled and richly-flavored nuts. It is a native of Persia and the regions about the Caspian Sea. The Greeks and Romans took it to southern Europe before the Christian era. It was brought to America in the early settlement of the country, but did not succeed everywhere, and the few trees that survive in the eastern states have been mostly neglected. Some of them have borne nuts abundantly and others have not. Unproductiveness has generally been due to the isolation of the trees and the inopportune times of the blooming of the flowers of the two sexes. These isolated trees are scattered over the eastern states from New York to Georgia, and rarely beyond the Appalachian mountain chain, because of the more uncongenial climate there. Whether or not there will eventually be orchards of this nut in the eastern United States is doubtful.

Regions of Successful Culture.—On the Pacific coast the Persian walnut is a great success. True enough, there are some failures, but they are mostly due to lack of proper pollination, a matter which can and will soon be generally understood and overcome. There are extensive orchards already in bearing, and with the advantages which are now being afforded by the introduction of the best varieties from Europe and the origination of improved seedlings, the walnut industry is sure to rapidly advance in that region. The soil of the richer valleys of the Pacific slope is just what is needed, and where there is an abundant supply of water a few feet under the surface there is no need of irrigation. But in poor, dry soil it is folly to expect success. The crop of California, alone, in 1899, was about 550 car-loads of 20,000 pounds each. It is confidently expected that California will, within a few years, produce all that our home markets require.

Propagation and Tillage.—The larger number of bearing trees are seedlings, but those grafted or budded with choice varieties are far preferable, and such trees will form the walnut orchards of the future. The distance for the trees to stand apart in the orchard is from 25 to 50 feet, according to the vigor of the variety and the richness of the soil. Clean tillage is best for the trees until they reach bearing age, when the ground may be seeded to some grass that does not make a compact sod. If hoed crops are grown between the trees until that time it will do no harm and economize the space. Almost no pruning is needed for this tree, except to keep the branches from getting so low as to interfere with tillage. See *Walnut.*

THE CHESTNUTS.—*American Species.*—Like the walnuts, our native chestnuts are not so desirable for market purposes as those from foreign countries. The wild American chestnut, *Castanea Americana*, is richer in quality than any foreign kind, but the size is less than half that of the introduced nuts. Throughout the larger part of the eastern United States, and extending into lower Canada, there are untold millions of native chestnut trees, yielding a wealth of nuts that find ready sale in the markets, so far as they are gathered; but the prices are only about half those of the large cultivated and imported product. At the present time there are but few attempts made to cultivate this species. Some of the choice varieties with the largest nuts are being collected for experiment, and there is reasonable prospect that by hybridization and selection of seedlings we may yet have varieties combining the vigor and hardihood of the wild trees with the characteristic natural sweetness and large size of the foreign nuts.

The chinquapin, *C. pumila*, is the smallest of the chestnut family, in size of both nut and tree. Rarely is it anything more than a mere bush. It has rarely been cultivated, although the bushes are productive and the nuts of good quality.

European Species.—The Old World chestnut, *C. sativa*, has been under cultivation almost as long as history goes. It was brought to America in the first century of its settlement by Europeans; but not until within the last 25 years has there been more than an occasional tree found on our shores. The accidental finding of a chance seedling, which was finally named Paragon and sent out to the public about 1887, and the bringing to notice of the Ridgeley shortly before that time, were the means of exciting the first general interest in chestnut culture in America. Both these kinds, and a great many more named varieties, are now being propagated and scattered far and wide. They are all of large size but not as sweet as our native chestnuts, and generally have bitter skins. The trees are of robust character and very productive, but more tender than our natives.

Japanese Species.—About the time that the European species was becoming popular in America attention was drawn to a number of seedlings from nuts that had been brought from Japan during several previous years. The most of them were larger than any that had been known before, either in this country or in Europe. Many of them are now named and widely distributed. Some of the smaller varieties are exceedingly early in ripening. Nearly all of them begin to bear at an early age and are even more productive than the average of the European species. In quality, the nuts of most of them are not quite so sweet as the European kinds. The habit of growth is less vigorous than that of other chestnuts.

From these two foreign species we have all of our varieties that, up to this time, are worthy of general cultivation. They vary from seed much as do most other improved varieties of fruits, etc., and grafting and budding must be practiced, which are exceedingly difficult to successfully perform on the chestnut, as is the case with all other nut trees. They will both unite fairly well with our native stocks; although sometimes the union is imperfect and the top breaks off.

Grafting.—The most successful method of propagating nut trees, so far as the writer has experimented or learned otherwise, is late bark-grafting. This requires that the cions be cut before there is any possibility of the buds starting, and put in some very cool place until after the stocks have begun to leaf out. The stocks are then cut off as for cleft-grafting, but the bark only is split with a knife for an inch or more at the top of the stock. The cion is trimmed to a long wedge, all from one side. The point of this wedge is introduced under the bark at the top of the slit and gently forced down until the cut surface of the cion is even with the top of the stump. It is then tied fast with a string and the wound securely waxed. Large trees may be thus top-worked in their branches with considerable success. Small stocks should be grafted just under the surface of the ground and banked nearly to the top of the cion.

Stump Groves.—In several cases large tracts of chestnut stump lands have been grafted over to the improved varieties of the foreign species with good success. All other trees should be cleared away and only two or three of the strongest sprouts left on each stump. These should all be grafted and allowed to grow until it is sure that there will be a sufficient stand, when those that are not needed should be cut away. In future years more may be cut away to give the remaining trees ample room.

Chestnut Orchards.—The best results are said to be attained in chestnut-culture by planting grafted trees on open land, about 25 feet apart and in regular orchard form. This plan admits of giving the trees good tillage until they have attained large size, when grass may be sown and stock allowed to graze it, except when the nuts are falling. Such orchards are said, by those who have tried them in comparison with grafted sprouts, to yield more than twice as much per acre. Well-drained sandy or shallow lands are the best for the chestnut.

Weevil.—The worst feature of chestnut-culture is the weevil. In some cases the nuts are so badly infested that they are practically worthless. The eggs from which the larvæ develop are laid by a long-snouted beetle while the nuts are growing, and by the time they are mature the most of them are either hatched or nearly ready to hatch. By treating the nuts with the fumes of bisulphide of carbon the eggs or larvæ can all be destroyed. Scalding with boiling water for about ten minutes will also kill them, but it also destroys the germinative power of the nuts and necessitates drying them. See *Castanea* and *Chestnut.*

THE PECAN (*Hicoria Pecan*).—*In the Wild State.*—Of all our native nuts the Pecan is the best. Its natural habitat is the lower Mississippi basin, from Iowa to the Gulf coast, but it will grow equally as well in any climate and soil of approximately the same character. The tree is almost as hardy as any of the other hickories, except some of its more southern varieties. In size the tree varies from medium, on land of ordinary fertility, to gigantic proportions on the rich river and creek bottoms. The nuts vary in size and shape from round and ½ an inch in diameter to oblong and 1½ inches in length. The kernels are exceedingly rich and sweet, and the shells usually thin. Pecans are found in all confectionaries, and bring almost as high prices as any of the imported nuts. The largest and thinnest shelled varieties are found in Louisiana and Texas. Millions of pounds are gathered annually in those states and sold to dealers, thus bringing a handsome revenue to many people of moderate means.

Under Cultivation.—The decrease of the wild product from the cutting down of the trees, and the better prices obtained from large, thin-shelled nuts, have induced the planting of pecan orchards. The nuts sprout readily, and the trees are of easy growth, with reasonable care, in proper soil and climate. In Texas there is one orchard of 11,000 trees planted on 400 acres and grown from the best nuts procurable. In Florida there is another of 4,000 grafted trees on 100 acres. There are many smaller orchards planted in nearly all the states from Virginia to Missouri and California, southward. The line of 40° north latitude is about the limit of successful pecan culture, and the region from 35° southward is much better. The nuts do not fill and ripen well where the growing season is short.

It has been learned that by cutting back the tops of wild trees (thus causing an abundance of sprouts), and then budding in August or September, large trees may be quickly transformed into such as will produce the highest grade of nuts.

Planning the Orchard.—There are two ways to make a pecan orchard. One is to depend on seedlings. If really choice nuts are planted there is a reasonable prospect of securing trees bearing somewhat similar nuts, and many follow this plan. The other is to depend on budded or grafted trees instead of seedlings. There is also a division of opinion as to the advisability of planting the nuts where the trees are to stand and rearing them for a year or more in a nursery. Both ways are good, but each has its advantages. If the former of these plans is followed, then two or three nuts should be planted where each tree is to stand and a cedar or cypress stake driven at the spot. Pine stakes are said to induce worms to attack the little pecan trees. A still safer plan is to enclose the little seedlings in narrow boxes about a foot high, made of cypress boards. This secures them from the depredations of rabbits, which sometimes prove very destructive. By this plan there is no labor or danger of loss by transplanting. All but one of the trees should be removed after two or three years' growth. If the nursery method is followed, the transplanting should be done at one of these ages.

Propagation.—Grafted or budded trees are far preferable to seedlings, because of the certainty of the variety, convenience of gathering the nuts at one time, and the advantage of having an even and high grade to sell. The same difficulty is met with as in case of the chestnut—the trouble and expense of securing grafted or budded trees. However, it has been found that both these methods of propagation are reasonably successful in skilful hands. Either the cleft-, tongue- or bark-graft will succeed, but all styles do better on small stocks just below the surface of the soil than above. Ring- and plate-budding are much more successful than the shield method. They have been profitably used in nurseries of young seedlings and on sprouts on large trees.

1497. Cocoanut.
The most important of tropical nuts.

Planting and Cultivation.—The distance for planting should be not less than 50 feet between trees, because they get to be very large. It might be well to put them half that distance and cut out half when crowding begins. Thorough tillage will pay abundantly and should never be neglected while the trees are young. Farm crops, such as corn, cotton and potatoes, may be grown between the trees until they begin bearing, which is from 10 to 15 years from planting. Then the ground may be seeded to grass. See *Hicoria* and *Pecan*.

THE COCOANUT (Fig. 1497).—*Where Grown in America.*—There is comparatively little territory on the continent of North America where the cocoanut will grow; viz., a small portion of Florida and the warmer coast regions of Mexico. In the warmer parts of California the climate does not seem to be sufficiently humid. In the vicinity of Lake Worth, Florida, there are many bearing trees, and along the east coast and adjacent islands from there to Key West, and as far north on the west coast as Charlotte Harbor, there are many thousands of cocoanut trees growing. In central Florida the climate does not seem to be suitable. Proximity to the sea in all countries seems to suit the cocoanut. It will flourish in almost any soil, although the richer the better, but a warm and humid atmosphere is indispensable.

Origin of Cocoanut-Growing in America.—The oldest cocoanut trees in Florida were probably chance seedlings which came from nuts that washed ashore from the sea long years ago. Such trees are very rarely found. There are also a few old trees that grew from nuts planted by settlers at Key West and other places along the coast. The chief cause of the impetus to cocoanut-growing was the wrecking of the Spanish bark Providencia laden with cocoanuts on the beach near Lake Worth, Florida, Jan. 9, 1878. Many thousands of the nuts were gathered from the surf and planted for many miles up and down the coast. The trees grew so rapidly and began to bear so soon, usually at from six to eight years from seed, that visions of wealth tempted many more into planting groves. One near Biscayne Bay consisted of about 4,000 acres, in which were 300,000 trees. Another at Cape Sable contained 42,000 trees, and there are many more of less extent.

Present Status.—Cold waves and occasional frosts have injured many of the cocoanut trees, in some cases killing them outright. In general, the trees bear good nuts in reasonable quantity, but in a business way the industry is uncertain, owing to danger from frosts and the cheapness of imported nuts. As an interesting novelty, the cocoanut in southern Florida is an eminent success. See *Cocos*.

There are three American publications devoted to nuts: "Nut Culture in the United States," 1896, being a bulletin of the Division of Pomology, U.S. Dept. Agric.; Fuller, "The Nut Culturist," 1896; Parry, "Nuts for Profit," 1897.

H. E. VAN DEMAN.

NUT-GRASS. Mentioned under *Cyperus*.

NUTMEG. Treated under *Myristica*.

NUTTÀLLIA (Thomas Nuttall, professor of natural history at Philadelphia; author of "The Genera of North American Plants" [1818], "The North American Sylva" [1842], etc.). *Rosàceæ*. A genus of 2 species of northwestern American plants, one of which is the Oso Berry, *N. cerasiformis*. This is a shrub 6–12 ft. high, with white, 5-petaled fls. It is one of the earliest shrubs to bloom in spring. It is rarely cult. in the East and of doubtful hardiness, but is esteemed in England, where it is compared to a flowering currant. Botanically, however, it is nearer Prunus than Rubus. Generic characters are: fls. polygamo-diœcious; calyx between top-shaped and bell-shaped, deciduous; petals broadly spatulate; stamens 15, in 2 rows, 10 inserted with the petals and 5 lower down on the disk lining the tube; filaments very short; carpels 5: drupes 2–4, oblong.

cerasifórmis, Torr. & Gray. OSO BERRY. Shrub or small tree, 2–15 ft. high: lvs. broadly lanceolate; petiole 2–4 in. long: racemes shorter than the lvs.: fls. ½–1 in. across: fr. blue-black, 6–8 lines long; flesh bitter; stone somewhat compressed. Moist places, Calif. Gn. 34, p. 78. G.C. II. 19:309; III. 19:489.—Said to "exhale a hydrocyanic odor." It endures the winter under protection at the Arnold Arboretum, Boston.

N. splėndidum, adv. 1889 by John Saul, is presumably an error. Probably some other genus.

NYCTERÍNIA. See *Zaluzianskya*.

NYMPHǼA (from *Nympha*, in Greek and Roman mythology, a nature-goddess). Syn., *Castalia*. *Nymphæàceæ*. WATER-LILY. POND-LILY. Figs. 1498–1502. The most splendid of aquatics (except Victoria), inhabiting the north and south temperate and tropical zones. About 32 well-marked species, with numerous local varieties and many cultivated hybrids. Herbs, perennial by horizontal or erect rootstocks or tubers, rooting in mud, covered by 3 in. to 6 ft. of water (rarely in bogs not submerged): lvs. floating, or when crowded rising a few inches above the water, round or oval, entire or dentate or sinuate, fissi-cordate, often sub-peltate, 2 in. to 2 ft. in diam.: fls. mostly showy, white, yellow, blue and red, in all shades, 1–12 or 14 in. across; sepals 4; petals and carpels many; stamens very numerous; pistil with a broad cup-like depression in the center of the fl., surrounded by a ring of fleshy processes, the carpellary styles, and with a knob at the center.

The petals and stamens of Nymphæa appear to be attached to the sides of the ovary; but this surface is to be considered as the outside of a cup-like receptacle, its cavity being completely filled by the radially placed carpels, with whose backs it is fused. Several species show easy gradations from sepal to petal and from petal to stamen, thus illustrating the homology of floral parts. The peduncles and petioles are traversed by a number of longitudinal air-canals, from whose walls star-shaped cells and rounded cell-groups project inward; in the walls of these stellate internal hairs are imbedded numberless minute crystals of calcium oxalate; they are objects of great beauty in microscopical sections. The distribution of these, as also of the air-canals, differs in different species. Three types of leaf may be distinguished: (1) very thin and fragile submerged leaves on short petioles; (2) floating leaves, thicker in texture, with stomata and palisade cells on the upper surface only; (3) aërial leaves, leathery in texture, sometimes, at least, bearing stomata on the under surface.

The leaves come from the rhizomes in spiral orders of varying complexity, from two-fifths up; the growing apex of the stem is protected by the colorless stipules and a dense growth of long, fine hairs. The roots spring usually from the bases of the leaves. Flowers are extra-axillary, arising as members of the leaf spirals or in a spiral of their own. The rhizomes of species which dry off in the resting season (Lotos, Hydrocallis, Lytopleura) become protected by a strong corky bark; others remain continually in a state of more or less active growth.

Habits of Opening.—The flowers of every species open and close at a particular time each day, so that in a pond with 18 or 20 kinds there is some change taking place at almost all hours. The hours of blooming are quite regular, though the tropical species are more sluggish in cool weather, and the hardy ones are irregular in very hot times. Each flower opens in from one or two to five or seven successive days (or nights), being about an hour later to open and an hour earlier to close on its first than on subsequent days. The flower then goes down into the water by a spiral coiling of the peduncle (or simply bending over if in shallow water) where the seed ripens. When in 6 to 10 weeks the pod matures and bursts, the seeds rise to the water-surface and float for several hours by means of a buoyant aril; this finally decays and drops the seed at some distance from the parent. To secure these, the floating seeds may be dipped up in a wire sieve, or better, the pods may be inclosed in muslin or cheese-cloth bags before ripening, all of the seeds being thus secured.

The Hybrids.—The species of a single group hybridize quite readily among themselves, and in the *Lotos* group the hybrids are more or less fertile. By means of this condition all shades of color have been obtained, from the pure white *N. Lotus*, var. *dentata*, to the dark crimson-red *N. rubra*. In this group and in *Castalia*, varieties have so multiplied of late and fanciful names have been so freely given that an accurate classification of all of them is no longer possible. In the *Brachyceras* group, hybrids occur almost certainly if *N. Zanzibariensis* is grown in the same pond with others of the group; thus have originated some very fine varieties. Outside of single groups only *Castalia* and *Xanthantha* have yet been interbred. Between the apocarpous and syncarpous species, the writer ventures to suggest, a hybrid would be impossible. Authorities differ as to the best time to transfer pollen; certain it is that the flowers are pistillate on the first day of opening, the pollen being shed on succeeding days, or late on the first day. Some say that pollination should take place in the early morning hours, about daybreak; others consider the time most favorable just as the flower is closing for its first time.

Trouble with the Names.—Great confusion has existed from the beginning in the naming—alike scientific and popular—of certain species of Nymphæa, partly from carelessness, partly because of the great variability of some species. A good degree of order was introduced by Caspary, though he left the matter still incomplete. *N. cærulea*, minutely described by Savigny, from Egypt, in 1802 (Ann. Mus. Paris. I p. 366 ff.), was immediately confused with *N. Capensis*, of South Africa, by the editor of B.M. and several other writers. It was also confounded with the very similar *N. stellata*, of India. Caspary, in Bot. Zeit. 1877, p. 200, finally set the matter straight, though American gardens are as yet not all corrected. *N. ampla* and *N. Amazonum* were confused because De Candolle's original specimen of *N. ampla* consists of a leaf of the first, with a flower of the second species; and *N. Amazonum* has been distributed in this country under the wrong name. Both are fully described by Caspary in Martius' Flora Brasiliensis (Fasciculus 77). *N. blanda* of our gardens is probably a form of *N. tuberosa*. The term *N. blanda* was first used by G. F. W. Meyer (1818) in a most faulty description of a member of the *Hydrocallis* group. The name was attached also to two other species of this group by later writers. See full description and synonymy in Fl. Brasil., l. c.

The True Egyptian Lotus.—Among common names the term "Lotus" has been remarkably misapplied. It seems to be consistently used among us for the genus Nelumbo, *Nelumbo nucifera* being generally styled "Egyptian" or "Sacred Lotus." Historically this is entirely wrong. Nelumbo is not native in Egypt, and is not now found there in a wild state. It was cultivated extensively along the Nile in the Roman period, probably for food, and the flower is supposed to have furnished one form of capital of the Egyptian columns. It is a native of southeastern Asia; is found near temples and carved on the walls of cave-temples in Hindustan, showing a veneration, which it shares, however, with *Nymphæa stellata*, *rubra* and *Lotus*. Nelumbo seems to have been regarded as sacred about temples in Japan and China. In Egypt, however, *Nymphæa cærulea* and *N. Lotus*, the "blue lotus" and "white lotus," are indigenous. The root (rhizome) of the former is said to have been pointed out as edible by Isis—or by Menes; its flowers, buds and leaves are often depicted on the monuments, the first sometimes in color. The flowers are figured among offerings under the IV. dynasty (3998–3721 B.C.), and the plant is certainly known from the V. dynasty. Petals of this and of *N. Lotus* were found in the tomb of Ramses II., the Pharaoh of the Israelitish captivity. *N. Lotus* was less regarded than *N. cærulea* in Egypt, though an object of profound veneration in India. Herodotus and other ancient writers speak of these Water-lilies indiscriminately as the "lotos" of the Egyptians. With these facts, and the additional one that, except as referred to above, Nelumbo never appears in Egyptian carvings, the identity of the sacred lotus cannot be doubted. But the erroneous use of the word lotus is deeply rooted, and may never be supplanted. Personally, the undersigned would not attempt to uproot it, but only to remember that the so-called "Egyptian Lotus" is not the plant of the tombs and monuments. (The lotus of Tennyson's poem, "Lotus Eaters," is still another plant, a shrub or tree which hangs out over the water; and the genus Lotus (q. v.) is distinct from all these.)

Economic Value.—The seeds and root-stocks of several Water-lilies, being very rich in starch, are used for food in parts of Africa, Asia, Australia and tropical America. The white-flowered species of Europe and America have been reputed medicinal. The herbage of all the species contains considerable tannin; nine substances of this class have been isolated from *N. alba*.

The Marliac Hybrids.—Two types of hardy, free-flowering hybrids akin to *N. alba* and its variety *rubra*, but of uncertain parentage, have been introduced in the last 10 or 12 years, one of sturdy habit, raising its lvs. (4–8 in. across) and fls. (3–6 in. across) well out of the water when crowded, the other slender in growth, the lvs. (3–6 in. across) and fls. (2½–4 in. across) usually floating. Most of these superb varieties were introduced by M. Latour-Marliac, of Temple-sur-Lot, France, whose methods, however, remain a mystery. It seems highly probable that excellent culture combined with careful selection, and wise hybridization have brought about these magnificent results. The first group seems to involve only *N. alba* (type) and *N. alba*, var. *rosea*. The second starts with a hybrid, probably of *N. alba*, var. *rosea* and *N. tetragona*, giving *N. Laydekeri*, var. *rosea*, to which is added, in varying degrees, blood of *N. alba*, var. *rosea* and *N. Mexicana*; but this does not by any means account for the whole group. Nearly all of both groups are entirely sterile. Believing that *N. alba*, and *N. alba*, var. *rosea*, have given a decided tone to both groups, we have described them as an appendage to this species, though some have more the habit of *N. tetragona*.

Important Species.—The following account, which contains 93 varieties and about 30 synonyms, will seem rather formidable to the beginner, but the species of the first importance are only 7 in number: *N. Lotus*, *rubra*, *odorata*, *tuberosa*, *alba*, *Capensis* and *Zanzibariensis*. The great majority of the other names represent garden varieties and hybrids. It is impossible for any form of arrangement to be clear and logical on the one hand, and exhibit natural relationship on the other, at least, not in a genus so greatly modified in cultivation. However, the true species are prominently indicated by bold-faced type and indention as usual, while their derivatives are thrown into the background.

Henry S. Conard.

Water-lilies or Nymphæas are among the most royal, gorgeous, diversified and universally admired plants in cultivation. No class of plants in our public parks can compete with them in attracting the people. Moreover, America is the most highly favored country in the world for the cultivation of aquatic plants. Ours is the only country which can have so rich and continuous a display of aquatics in flower from April to October in the open without artificial heat.

The Procession of the Water-lilies.—In our parks and private gardens are to be seen, flowering early in spring, all our native Nymphæas, and others from Europe and Asia. The species begin to flower in April and continue until early fall, when a number of the hardy hybrids continue to flower uninterruptedly until the end of the season. In the central states and southward the hardy varieties decline when tropical weather sets in, and the nights and days are hot. In the eastern states, and especially near the coast, where the nights are cool, the season is much longer, and the color of some of the pink varieties is more intense. Following the hardy Nymphæas come the Nelumbiums in all their oriental splendor, brightening the summer season, and bridging over the declining period of the hardy Nymphæas, and the approaching season of the tropical Nymphæas, which arrive at maturity toward the latter end of July or beginning of August, and continue until fall. Finally the grandest of all aquatic plants, *Victoria regia*, may be seen in America growing in a natural pond, and producing its chaste flowers as late as the middle of October.

The American Climate and American Species.—America is rich in native species of Nymphæa, and it is the only country which has native white-, pink- and yellow-flowered species.

Of the American Nymphæas there are about 5 that are best known. The common white Water-lily is *Nymphæa odorata*. Its variety *rosea* is the Cape Cod Pink Water-lily. *N. tuberosa* (Syn. *N. reniformis*) is a white-flowered species, inhabiting the western lakes. The yellow kind, *N. flava*, is indigenous to Florida and other southern states, but is hardy in New Jersey and southern New York. Another southern kind is the white-flowered *N. odorata*, var. *gigantea*. In addition to the above well-known kinds, there are several distinct forms and hybrids.

The commencement of the cultivation of aquatics in America led to the commingling of species, especially of *N. odorata* and *tuberosa*. The result is that in several sections are to be found many similar varieties, and forms of both white and pink, some of which are valuable, being distinct in color and having large, handsome, fragrant flowers, while a host of others are worthless, so far as distinct varieties are concerned. *N. tuberosa* was known as the largest and purest white Water-lily, distinct in foliage, flowers and rootstock. This species has proved to be the most susceptible of cross-fertilization. One great hindrance to the cultivation of such half breeds, is that most of them produce seed. The seedlings are either white or pink, and seldom, if ever, like the parent plant. There are in different sections of the country distinct forms of *N. tuberosa*, some having long, narrow petals and slightly fragrant flowers, others again having broad, incurving petals, forming handsome cup-shaped, highly fragrant flowers; still others have very full flowers, quite double, the numerous petals crowding each other until the reflexed sepals inclose the stalk, forming spherical flowers like balls of snow. *N. tuberosa*, in any of its forms, should not be planted in a small pond with other Nymphæas, for it is such a rampant grower that in a short time it will smother the less vigorous kinds. This species delights in plenty of space, and water 2 to 3 feet deep, with soil of a tenacious character. However, it will thrive in almost any soil, and is well adapted for naturalizing in lakes and ponds. Attempts at naturalizing or cultivating on a small scale have not been very satisfactory; but the species will well repay any extra care to establish it in desirable localities.

Foreign Species and Recent Triumphs in Hybridization.—Two or three species are indigenous to continental Europe, notably *N. alba*, the well-known English white Water-lily, *N. candida*, the white Bohemian Water-lily and *N. alba*, var. *rosea*, the Swedish Water-lily. The last named is the only distinct or true red-flowered, hardy species. Still another species, which has played a very important part with specialists of the present day, is *N. tetragona* (*N. pygmæa*), from China and Japan.

N. odorata was introduced into England during the eighteenth century, and was probably the first foreign Nymphæa to reach that country. Other species followed later, mostly tropical; but, although the English people were ardent horticulturists and lovers of the beautiful in nature over a century ago, Nymphæas never became popular, and remained a neglected class of plants until a few years ago, when M. Marliac, of Temple-sur-Lot, France, conceived the idea of crossing the English white Water-lily with the well-known Cape Cod pink Water-lily, and the Florida yellow variety. Nothing in the horticultural world has created more surprising results in the blending of the American and English species. These species have been the progenitors of numerous varieties, which have made this class of plants the most popular and desirable of all aquatic decorative plants, and within reach of all. Their popularity has kept constantly increasing and ever brightened by new additions. America, too, has contributed its quota to the list of novelties, and some of these are unsurpassed by any European introductions.

The General Principles of Water-lily Culture.—From the apparently simple conditions under which our native varieties are found growing, many amateurs have concluded that all these plants require is water and possibly some mud to keep the roots in. Many attempts have been made to grow these plants in pails and tubs, with the inevitable result—failure. Professional gardeners, also, have made grievous errors, for, while they have used every means to secure fine specimen plants of flowers, vegetables and luscious fruits, they have usually given meager attention to Water-lilies, and have not supplied half their wants. Water-lilies, all Nymphæas, succeed best when grown, as near as possible, under their existing natural conditions; these are a rich alluvial soil in abundance, water, and clear uninterrupted sunlight. Where natural ponds exist these conditions are found, but often there is a deficiency of light, caused by shade trees. Let the trees remain, but select open spots for the Nymphæas. They may be planted on the margins of sluggish streams, in bays and sheltered nooks.

Construction of Artificial Ponds, etc.—Where artificial ponds are resorted to, the most satisfactory method is to build solid walls of masonry, with a concrete bottom, provided with an outlet and overflow. In all cases make the pond as large as existing means will allow, not for a moment considering it possible to be too large. One method of providing for the sustenance of these plants is to place a layer of soil in the bottom of the pond from 9–12 or more inches deep. This will suit the plants admirably. Artificial ponds are usually constructed in a conspicuous spot, where everything is required to be well kept. In such situations it is necessary occasionally to take off some dead leaves, or cut a few choice flowers, and if they cannot be reached from the edge of the pond, the attendant must wade in after them. The result is that the water, which should always be clear, is muddy, and when it settles there is a muddy deposit on the leaves that makes them very unsightly. Moreover, this treading in the soft soil breaks numerous roots. To avoid these and other attendant evils place the soil in boxes from 3–4 feet square, and 1 foot deep, and in these plant one single plant of the vigorous and moderate growers, allowing ample space between the boxes. One plant of any tropical Water Lily grown in such a box will require from 50 to 100 square feet of water surface, as will also the strong varieties of hardy Nymphæas, since these may remain two years undisturbed, although some of these are best replanted every season.

1498. Nymphæas in an effective and natural setting.

The pond should be 2 to 2½ feet in depth. The soil should be a strong loam, the top-soil from a pasture composted with cow manure in proportion of one-third. This should be prepared six months, at least, before planting time. This soil is suitable for all aquatic plants. In any case, when filling the boxes or placing the soil in bottom of pond, tread moderately firm and cover with an inch of sand.

The water may be spring water, rain water or that from any available source. The clearest spring water will soon turn green from exposure to the sun and air, but after fermentation settles clear. Do not place the plants in a newly constructed pond or basin immediately after it is finished, as the caustic property of the cement will injure the plants. Let the water stand a few days, or if the basin is small, the water may be changed. Planting of the hardy varieties may be done in April and May, according to the latitude and earliness or lateness of season. The conditions should be conducive to active growth at once. Tropical Nymphæas should not be planted until there is evidence that summer has come. Hardy Nymphæas may be planted during spring and summer; late planting is better than deferring till next spring, as the plants under such conditions will get established before autumn closes, and the plants will start naturally in spring, receiving no check.

The above method of construction and cultivation is to be commended, but other methods are adopted with a fair amount of success, but with attendant evils which are discouraging and at times very annoying and costly. Tanks or artificial ponds may be constructed with cement, digging the pond the desired size, having sloping sides and afterward lining the same with concrete and finishing with a facing of cement. However, such a pond will not stand the effects of hard freezing weather even if protected; and what is worse, the new or freshly removed soil will settle during the season, and the pond is very apt to spring a-leak. Some morning the pond is likely to be found empty of water just as the plants are showing their first flowers.

Another method of construction which is better than the preceding is to line the pond with well-tampered clay, from 4–6 in. thick, afterward covering with 2 in. of sand. Such a pond can be made water-tight, but the sides will wash and repairs are needed; the water is muddy and the plants are dirty and anything but a thing of beauty and a joy forever.

There are yet the advocates for tub culture. Yes, plants will grow in tubs, and as soon as the plant-food is exhausted, which is often at an early date, the plants exist awhile and then draw out a miserable, exhausted and discouraging career.

Fountain basins are often made the receptacles for Nymphæas. There they may be grown if the right conditions are accorded them, but there must not be a stream or spray of cold water running all the time, as the water can readily be made cold, chilling the plants and checking their growth.

Enemies.—Nymphæas have insect pests like other cultivated plants. Aphides are sometimes troublesome. The best remedy is their natural enemy, the "lady bugs" or "lady birds." A colony of these voracious insects makes short work of the aphides, as do also the lace-winged flies. An insect of recent acquaintance with Nymphæas is a leaf-miner, the larva of a small fly, which cuts channels through the leaf in all directions. Sometimes only a few of these are in evidence, at other times the leaves are fairly alive with them. The trouble is easily detected. The marks suggest Japanese writing or the efforts of youthful artists. A simple and effective remedy is kerosene emulsion, applied with a fine spray at evening after the flowers are closed. Another troublesome insect has its home in Florida, and has come north to spend the summer in a favored clime. This is a leaf-cutter, *Hydrocampa proprialis*. The larva cuts out pieces of the leaf and hides between two pieces, which makes a kind of tent. In this tent the larva moves about. At first it moves slowly, but as it nears maturity the larva becomes ravenous and then eats the surface of the leaves near the center, and cuts off much larger pieces of the leaf for camping-out purposes. The best remedy for this pest is a lamp trap for the mature insect. Frogs and dragon-flies will catch numbers of them.

Nymphæas are also subject to a fungous disease, a leaf-spot which is easily discerned after a spell of warm, humid weather. After such a spell of weather, followed by bright sunshine, the leaves are scorched and crumpled, and as a result, the plant is sadly crippled by being denuded of its foliage; new leaves are weak and smaller, and so too are the flowers, if indeed there are any. This disease must be checked at once or the plants will be severely set back, if not ruined. The only remedy is Bordeaux mixture, or any of the various mixtures with sulfate of copper as the basis. Use a fine spray, and dilute the mixture to half the strength recommended for most plants. It is best to spray twice with a weak solution rather than to spray once with too strong a solution and to damage the foliage. WM. TRICKER.

WATER-LILIES IN CALIFORNIA.—The culture of Nymphæa in California presents fewer difficulties than in the eastern states. The varieties which are hardy in the East flourish equally well and bloom for a longer period. In frostless localities, especially where the lemon tree is free from injury, such tender varieties as *Nymphæa Devoniensis*, *N. dentata* and *N. Zanzibariensis* may be left in the open pond during winter. In colder localities the tubers should be removed to warmer quarters in November to remain until spring. If a greenhouse is not available, a small pool built in such a manner that it can be covered with hotbed sash will afford suitable protection. Very little room is needed for these when they are dormant. The manner of cultivating both the hardy and tender varieties is much the same in California as in the eastern states. For growing a small collection a pool 8 or 10 feet across may be made by excavating 2 or 3 feet, making the walls of concrete, brick or stone, and covering the bottom with concrete. The best quality of cement should be used for all the work. An overflow pipe should be put in and so arranged that the pool may be emptied when occasion requires. Basins 20 or 30 feet in diameter, or even larger than this, are desirable for growing a good collection. In a small pool, wooden boxes 10 inches deep and 18 inches to 2 feet square may be used to hold soil for the plants. In a large basin some of the boxes may be 3 or 4 feet square. While most aquatics will flower freely in contracted quarters, they will attain greater perfection and produce much larger flowers if they have abundance of room both for the roots and the leaves.

The majority of these plants are gross feeders, and it is well-nigh impossible to make the soil too rich for them. It is not necessary to go to a swamp or natural pond to obtain what is suitable. Any soil which will grow good vegetables will, if properly enriched, grow Water-lilies. A compost, consisting of two-thirds good soil and one-third thoroughly decayed cow or stable manure, with a sprinkling of bone meal, is recommended. A dark friable loam, which is intermediate between "adobe" and sandy loam, is desirable for this purpose. The tenderest varieties, such as *N. Devoniensis* and *N. dentata*, will flower for a long period without any forcing; but if started into growth in March in a greenhouse or hotbed and planted in the pond in May, there will be a great gain in the length of the flowering season. The soil for the tender varieties should be renewed every year, and that for the hardy ones every two years.

If aphides or the worm known as the leaf-roller make their appearance the leaves should be sprayed with kerosene emulsion very much diluted, using 1 part emulsion to 15 of water. If large ponds or lakes with a natural earth bottom are used for growing Water-lilies, care must be taken that noxious weeds do not get a foothold. Cat-tails (*Typha latifolia*) and "tules" or bulrushes are troublesome if not destroyed when they first make their appearance. In California the number of tropical and subtropical trees, shrubs and plants which may be planted out permanently is very great. Palms, both fan-leaved and feathery, giant bamboos, Musas, Strelitzias, Papyrus, giant grasses, Fatsia and Caladiums are among the things which can be used to ornament the surroundings of the water-garden.

EDMUND D. STURTEVANT.

THE GENUS NYMPHÆA divides itself readily into 2 main divisions, which again are subdivided into 6 groups, according to Caspary (Ann. Mus. Lugd.-Bat. 2, p. 240 ff.; Engler-Prantl. Pflanzenfamilien 3, 2, p. 7 ff.):

Section I. *Syncarpous Nymphæas*, i. e., carpels entirely fused together. (*Symphytopleura*, Casp.)

Subgenus I. LOTOS. Sepals prominently veined: a space between the insertion of the petals and stamens: stamens broad, flat, rounded at apex: carpellary styles linear: lvs. sharply dentate: rhizome ovate, stoloniferous.—Tender night-bloomers: fls. red or white on strong scapes 3–12 in. above the water, opening on 4 successive nights. Two or 3 species in S. Europe and Asia and N. and Central Africa.

Subgenus II. HYDROCALLIS. Sepals not evidently nerved: carpellary styles long, club-shaped: petals in alternating circles of 4: stamens much as in CASTALIA, all opening about the same time: rhizome ovate, stoloniferous.—Tender night-bloomers: fls. creamy white. About 9 species in tropical America.

Subgenus III. XANTHANTHA. Sepals not evidently nerved: plant spreading rapidly by runners (except in hybrids): fls. yellow throughout; stamens as in CASTALIA: rhizome short, erect.—Day-bloomers, half-hardy. Two species in S. North America.

Subgenus IV. CASTALIA. Sepals not evidently nerved: carpellary styles flat, not clavate: outer stamens petaloid, becoming narrower inward: inmost stamens first to ripen, their filaments short, narrower or but slightly wider than the anthers: rhizome horizontal (except in *N. tetragona*), with no bark or other protection against drought.—Hardy day-bloomers: fls. white, pink or red. Mostly natives of temperate climates. About 6 species in Europe, N. Asia, and America.

Section II. *Apocarpous Nymphæas*, i. e., carpels free at the sides, united at their edges to the central column of the fl. and at their backs to the receptacle.—Outermost stamens ripening first, inmost last: rhizome ovate, stoloniferous.—Tender day-bloomers: fls. on strong scapes 4–12 or 14 in. above the water. (*Lytopleura*, Casp.)

Subgenus V. Brachyceras. Outermost stamens with an appendage above the anther: carpellary styles short, triangular: fls. white, blue or pink.—About 12 species in the tropics all round the world.

Subgenus VI. Anecphya. Stamens all slender, half as long as the petals, almost without any appendage: carpellary styles wanting: fls. blue, rosy or white. One species in Australia.

INDEX.

advena, see Nuphar.
alba, 48.
albida, 52.
Amazonum, 25.
ampla, 25, 80.
Andreana, 65.
Arnoldiana, 19.
Astræa, 92.
Aurora, 66.
azurea, 90.
biradiata, 47.
blanda, 24, 26, 43.
Boucheana, 16.
cærulea, 76, 81, 84.
candida, 47.
candidissima, 51.
Capensis, 81, 88.
carnea, 54.
Carolinensis, 38.
Caroliniana, 38.
chromatella, 31.
colorans, 8.
Columbiana, 12.
Deaniana, 7.
delicatissima, 6.
dentata, 2.
Devoniensis, 15.
Diana, 14.
Eastonensis, 9, 82.
edulis, 1.
elegans, 75.
Ellisiana, 67.
exquisita, 40.
flammea, 71.
flava, 28.
flavescens, 31.
Froebelii, 50.
fulva, 63.
Geo. Huster, 13.
gigantea, 37, 93.
Gladstoniana, 53.
gloriosa, 68.
gracilis, 83.
grandiflora, 14.
Greyae, 87.
helvola, 30.
ignea, 72.
James Gurney, 69.
Jubilee, 4.
Kalmiana, see Nuphar.
Kewensis, 21.
Lælia, 8.
Laydekeri, 57–60.
Lotus, 1.
Luciana, 39.
lucida, 61.
Marliacea, 31, 52–74.
Mauvii, 86.
maxima, 44.
Mexicana, 27.
micrantha, 77.
minor, 35.
Mrs. C. W. Ward, 85.
Niobe, 20.
nitida, 33.
odorata, 34.
O'Marana, 18.
Ortgiesiana, 2, 17.
Parkeriana, 42.
plena, 45.
pubescens, 3.
pulcherrima, 78.
pygmæa, 32.
reniformis, 43.
Richardsonii, 45.
Robinsoni, 62.
Robinsoniana, 62.
rosacea, 41.
rosea, 11, 36, 46, 56, 91, 92.
rubicunda, 23.
rubra, 10, 17, 36.
rubra-punctata, 73.
Rudgeana, 24.
sanguinea, 74.
scutifolia, 76, 81.
Seignoreti, 64.
semiaperta, 47.
Smithiana, 5.
sphærocarpa, 49.
stellata, 76, 79.
Sturtevantii, 22.
sulphurea, 29.
superba, 38.
tetragona, 32.
thermalis, 1.
tuberosa, 43.
Union, 35.
versicolor, 79.
Wm. Doogue, 55.
Wm. Falconer, 70.
Wm. Stone, 84.
Zanzibariensis, 89.

SECTION I. SYNCARPOUS NYMPHÆAS.

Subgenus I. Lotos.

A. *Fls. white or light pink.*

1. **Lòtus,** Linn. (*N. édulis*, DC. *N. thermàlis*, DC., of the hot springs of Hungary). White Lotus. Fig. 1499. Lvs. orbicular, dark green above, under surface brownish, smooth or slightly pubescent; diam. 12 to 20 in.: fls. white, the broad outer petals suffused pink, 5 to 10 in. across, open 7:30 P. M. to 11 A. M.; sepals pure green; petals concave, 19 or 20; stamens 96–103, yellow; anthers shorter than the filaments. Egypt. B.M. 797. F.S. 7:706–7.

2. Var. **dentàta,** Schumacher & Thonning (*N. Ortgiesiàna*, Planch.). Lvs. glabrous or somewhat puberulent beneath: fls. pure white, 8 to 10 in. across, open until 1 P.M.; petal narrower than in the type, ovate, opening out horizontal; anthers longer than the filaments. Central Africa, Sierra Leone. B.M. 4257 (as *N. dentata*). F.S. 6:627–8.

3. Var. **pubéscens,** Willd. Lvs. densely pubescent beneath: fls. white; outer petals tinged pink. India.

Garden Varieties of Nymphæa Lotus.

N. Lotus and varieties seed freely, and are valuable seed-parents for hybrids, of which the following may best be classed here: 4. *Jubilee*, with fls. delicate pinkish white: lvs. blotched with brown, crumpled at margin. Distributed by Henry A. Dreer, Riverton, N. J., in 1899.—5. *Smithiàna* (N. Lotus × N. Lotus var. dentata). A shade more pink than 4: petals broadly ovate: lvs. plain dark green, lying flat at margin. Distributed by W. Tricker from Clifton, N. J., in 1893.—6. *C. delicatissima* (N. Lotus var. dentata × N. rubra). Light pink; a shade darker than 5: lvs. slightly bronzy, a little crumpled at margin. Distributed by W. Tricker from Clifton, N. J., in 1894.—7. *Deaniàna*. Hybrid same as 6. Pure light pink; darker than 6: sepals deep rose pink; petals broadly ovate; stamens red: lvs. dark green, scarcely bronzy, much crumpled at margin. Sent out by W. Tricker, from Clifton, N. J., in 1894.—8. *Lælia* (N. Columbiana × N. Smithiana). White or nearly so: lvs. bright green. Var. *colòrans*, smaller than type: fls. shaded pink: lvs. with open sinus. Originated with O. Ames, N. Easton, Mass., 1900.—9. *Eastonénsis* (N. O'Marana × N. Smithiana). Lvs. dark green, bronzy when young; sinus wide: fls. white. Originated with O. Ames, N. Easton, Mass., 1900.

AA. *Flowers red.*

10. **rùbra,** Roxbg. Lvs. orbiculate, reddish brown, bronzy, becoming greenish, pubescent beneath, 12 to 18 in. across: fls. deep purplish red, 6 to 10 in. across, open 3 or 4 nights from 8 P. M. to 11 A. M.; sepals dull purplish red, 7-nerved, never opening more than 10° above horizontal; petals 12–20, narrowly oval, rounded at apex; stamens about 55, cinnabar-red, becoming brownish. India. B.M. 1280. F.S. 6:629.—Only distinguishable from *N. Lotus*, var. **pubescens,** by color of fls. The two run into each other and may not be specifically distinct.

11. Var. **ròsea,** Sims. Lvs. bronzy green, blotched with brown: fls. large, magenta to dark red, open from 8 P. M. to 10:30 A. M.; petals narrow, pointed; stamen tips orange-brown. India. B.M. 1364.

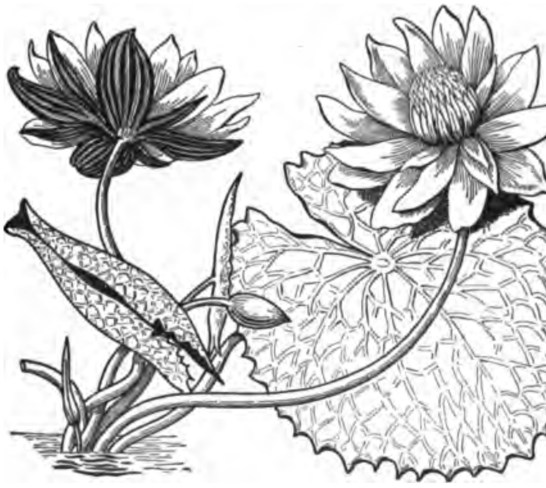
Garden Varieties of Nymphæa rubra.

FIRST GROUP.

12. *Columbiàna*, with deep red fls., darker than the type, of medium size (6 in. across): foliage dark bronzy red. Chance seedling from N. rubra. Sent out by W. Tricker from Clifton, N. J., in 1894.—13. *George Huster*. Fls. deep red, 8–10 in. across, closing about 11 A. M.: lvs. bronzy green. Sent out by Henry A. Dreer from Riverton, N. J. in 1899.—14. *Diana* (N. Sturtevantii × Amazonum). Intense magenta shaded with crimson; lvs. deep olive-brown, sinus open. A.G. 21, p. 517. Var. *grandiflòra* is larger and deeper in color. Originated with O. Ames, N. Easton, Mass., 1900.

SECOND GROUP.

15. *Devoniénsis*, Hook. Fig. 1500. Lvs. dark bronzy green, moderately peltate, lying flat on the water, 18 in. across: under surface greenish brown, puberulent: fls. pure red, 10–12 in. across, open from 8 P. M. to 1 P. M. of next day; petals ovate, 4 or 5 in. long by 1½ in. wide. B.M. 4665. The first hybrid of note (if hybrid at all); said to be N. Lotus × N. rubra, raised at Chatsworth, Eng., in 1851. A universal favorite.—16. *Boucheàna*. Very near 15; hybrid(?), of same parentage; color of fls. a little lighter. F.S. 10:1033–4.—17. *Ortgiesiano-rubra*. Much like 15: fls. dark red. F.S. 8:775–6.



1499. Nymphæa Lotus.

Redrawn from the old figure in Botanical Magazine (1804), showing an historical picture of the true white Egyptian Lotus.

THIRD GROUP.

18. *O'Maràna*. Lvs. bronzy green, margin occasionally crumpled: fls. 10–12 in. across, open from 7:30 P. M. to 1 or 2 P. M. of next day; sepals reflexed when fully open; petals pinkish red, with a nearly white streak up the middle; stamens orange. N. Lotus × N. Sturtevantii, sent out by P. Bisset, Washington, D. C., about 1894.—19. *Arnoldiàna*. Much smaller than 18: lvs. somewhat crumpled: petals crumpled. N. Lotus var. dentata × N. rubra, by G. W. Oliver, Washington, D. C.—20. *Niobe* (N. rubra × ———). Bright carmine pink: lvs. undulate and dentate margined, dark green above, sinus open. Originated with O. Ames, N. Easton, Mass., 1900.

AAA. *Fls. pure pink.*

GARDEN HYBRIDS OF N. LOTUS AND N. RUBRA.

21. *Kewénsis*, Hook. f. Lvs. orbicular, dark green with a few brown patches, slightly bronzy, lying nearly flat on the water, rather broadly peltate: fls. 6 to 8 in. across, light pink; petals broadly ovate; sepals light brownish green. N. Lotus, var. dentata × N. Devoniensis, raised at Kew in 1885. B.M. 6988. Said to have died out, but a plant of that name and description is still found in American gardens.

22. *Sturtevántii*, Hort. Lvs. light bronzy green, rather broadly peltate, much crumpled at margin: fls. 8–12 in. across, quite double, pure pink to bright red, closing about 11:30 A. M.; petals very broad, concave, incurved; stamens incurved, tips light brownish orange. G.F. 7:355. A huge massive flower; varies greatly in color of leaf and bloom, according to culture. Chance seedling from N. Devoniensis, raised in 1884 by E. D. Sturtevant at Bordentown, N. J.—23. *rubicúnda*, Ames (N. Sturtevantii × N. Lotus). Deep rich pink: lvs. dark green. Originated with O. Ames, N. Easton, Mass., 1900.

SUBGENUS II. HYDROCALLIS.

24. **Rudgeàna**, G. F. W. Meyer (*N. blánda*, Planch., not of gardens). Lvs. elliptic to suborbicular, 18 in. long, margin coarsely and irregularly sinuate-dentate: fls. 3–6 in. across, imperfectly open 2 or 3 nights from twilight until dawn. Usually only the sepals and 4, 8 or 12 outer petals open, the remaining parts forming a closed ovoid bud; occasionally a slight aperture is formed by drawing apart of the tip of the bud, which occurs before midnight. Petals usually 16–20; stamens 43–83. Trop. Amer. Flora Brasiliensis 77, pl. 32, 34, 35, 38. Not in cultivation here.

25. **Amazònum**, Mart. & Zucc. (*N. ámpla*, of American gardens). Lvs. ovate, entire; lobes rounded; upper and lower surfaces spotted brownish or blackish, under surface reddish brown; petiole with a ring of long hairs at the point of joining the leaf: fls. 3–6 in. across, imperfectly open 1 or 2 nights; the bud opens about half and closes again between 3 and 6 A. M. the first night; the second night the sepals and outer row of petals open about 7 P. M., the other parts remaining as a tight, white bud until 3.30 A. M., when the fl. opens fully from 4.30 to 5 A. M., then closes by 6.30 A. M. and draws down into the water; petals usually 20; stamens 93–297. Tropical America. Fl. Brasil. 77, pl. 35. B.M. 4823.

26. **blánda**, G. F. W. Meyer (not of American gardens). Lvs. small, membranous, entire, suborbicular; lobes slightly produced, subacuminate and subhastate: fls. 4 in. across; habits of opening unknown; petals 16; stamens about 65. Central and S. Amer., in the tropics. Fl. Brasil. 77, pl. 36.—Not in cultivation.

1500. Nymphæa Devoniensis (× 1-20). No. 15.

SUBGENUS III. XANTHANTHA (and hybrids).

A. *Spreading by runners (type species).*

27. **Mexicàna**, Zucc. Floating lvs. ovate, margin obscurely and finely sinuate, dark green above, beautifully blotched with brown; under surface dark crimson-brown, with small blackish dots, when crowded the lvs. rise 3–5 in. above the water, are orbicular, cup-shaped by overlapping of the straight sinus-margins, entire, 3–5 in. across, dark green and shining above, under surface bright green, with fine purplish brown mottlings: fls. 4 in. across, raised 4–5 in. above the water, bright canary yellow, open from 11 A. M. to 4 P. M.; petals 23, grading in size and shape insensibly into the stamens, which are about 50, light golden-yellow; rhizome erect, tuber-like, discoid, plane beneath, 3–5 in. in diam.; runners terete, ½ in. thick, white, rooting at the tip and sending up lvs.; the young plant flowers in a few weeks and again sends out runners. Mexico.

28. **flàva**, Leitner. Like 27, but more slender, weaker grower, less free bloomer, fls. paler yellow. Probably only a variety. Florida, in St. John's and Miami rivers. B.M. 6917.—Hardy as far north as New York, "in 2 ft. of water, covered with boards and a few leaves;" Gerard, in G.F.

AA. *Without runners (hybrids).*

29. *odoratà*, var. *sulphùrea*. Lvs. all floating, 4–6 in. across, like N. odorata, but blotched with brown: fls. light yellow, 4–5 in. across, borne 2–4 in. above the water; open during the morning. One of Marliac's hybrids, doubtless N. odorata × N. flava. Hardy. Shown in Paris in 1889.

30. *tetrágona*, var. *helvòla* (N. pygmæa, var. helvola, Marliac). Lvs. floating, oval, 3–4 in. across, similar in shape to those of N. tetragona, blotched all over with brown: fls. floating, small, yellow, 2 in. across, open during the afternoon. Hybrid, probably N. tetragona × N. Mexicana. Hardy. Introduced into America about 1892.

31. *Marliàcea*, var. *chromatélla* (N. tuberosa, var. flavescens of Kew.=N. Marliacea). Floating lvs. orbicular, much blotched with brown, 3–8 in. across; when crowded the lvs. rise as much as 8 in. above the water, are dark green above, lighter beneath; petioles sometimes with longitudinal brown stripes; fls. bright yellow, 3–6 in. across; petals numerous, broad, concave: stamens deep yellow. Hybrid, raised by Marliac; probably N. Mexicana × N. tuberosa (or alba). Strong grower, free bloomer; a general favorite. Flowered in this country in 1889.

SUBGENUS IV. CASTALIA.

A. *Rhizome erect: fls. pure white.*

32. **tetrágona**, Georg. (*N. pýgmæa*, Ait.). Lvs. horseshoe shape, entire, the lobes diverging, slightly produced and subacute, dark green above, inclined to brown blotching, reddish beneath, 3 to 4 in. across: fls. 1¼–2¼ in. across, open on 3 or 4 days from noon until 5 P. M.; base of fl. square; petals 13–17; stamens about 40, yellow. E. Siberia, China and Japan; also in N. Idaho, U. S., and Ontario, Canada. B.M. 1525.—The smallest of the genus; free bloomer; makes no side shoots from the single crown, but grows readily from seed. Seed next to the largest of the genus.

33. **nítida**, Sims. Lvs. entire, suborbicular; lobes obtuse: fls. white, cup-shaped: tender. Described in B.M. 1359 without habitat, and never positively identified since.

AA. *Rhizome horizontal or, if not, fls. pink or red.*

B. *Lvs. scattered loosely on the rhizome.*

34. **odoràta**, Ait. SWEET-SCENTED WATER-LILY. Lvs. nearly orbicular, entire, somewhat coriaceous, dark green above, purplish red when young; under surface deep red to reddish green or almost pure green; diam. 5–10 in.; lobes usually diverging, but often touching or slightly overlapping; petioles greenish or brownish: fls. (in the type) white, 3–5 in. across, open three days from 6 A. M. till 12 M.; sepals green, tinged with reddish brown; petals 23–32, ovate to lance-ovate; stamens 55–113, yellow; outer filaments broad, white, petaloid; seed medium sized. Eastern U. S., common. B. M. 819 (small).—Varies greatly in size and color, approaching *N. tuberosa*.

35. Var. **minor**, Sims (*N. Union*). Lvs. deep red beneath (or green when aërial): lobes diverging; diam. 2–5 in.; fls. white, 2¼–3¼ in. across; sepals strongly purple-colored; petals 17–24; stamens 37–78. Sometimes growing where water recedes entirely in summer; usually in shallow water. Same range as type; often a shy bloomer. B.M. 1652.

36. Var. **ròsea**, Pursh (var. *rubra*). CAPE COD WATER-LILY OR POND-LILY. Lvs. dark reddish on both sides when young, becoming green above: fls. pink, fading on the successive days of opening, 4 in. across. Southeastern Massachusetts. B.M. 6708 (too pale).

37. Var. **gigantèa,** Hort. Rice-field Water-lily. Lvs. large, 12–16 in. across, green beneath, at times tinged purplish toward margin; edge often turned up; petioles green: fls. 4–7 in. across, pure white; sepals green; petals 24–31; stamens 69–120. Del. to Fla. and La. Approaches *N. tuberosa.*

Garden Varieties of the N. odorata Type.

38. *Caroliniàna,* Hort. (var. Carolinensis = var. superba—N. tuberosa, var. superba). Lvs. entire, 12 in. across, sinus barely closed; green above, red beneath: fls. fragrant, 7 in. across; petals narrow, abundant (42?), delicate rosy pink: rhizome stout. A robust plant, raised by Dr. Bahnsen. Salem, N. C., about 1890. Probably N. odorata, var. rosea × N. tuberosa.—39. *Luciàna,* Hook. Like 38 in habit, etc., fls. rosy pink.—40. *exquisita,* Marliac. Lvs. green above, intense red beneath: fls. large, rosy carmine, darkest of this group; very near to 36. Introduced about 1890.—41. *rosàcea,* Marliac. Fls. salmon pink, more delicate in tint than 36. Int. by Marliac in 1891.

42. **Parkeriàna,** Lehm. Habit and foliage of 34: fls. large, pure white with bright yellow stamens and 16–20-rayed stigma; petals broader and shorter than 34. Guiana.

43. **tuberòsa,** Paine (*N. renifórmis,* Walt. (Gray) *N. blanda* of gardens?). Fig. 1501. Distinguished from No. 34 chiefly by the numerous slenderly attached and spontaneously separating tubers, 1–3 in. long on the rhizome. Lvs. when floating less coriaceous than in 34, and more veiny above; petioles marked with longitudinal brown stripes; no purple or red color about lvs. or sepals: fls. 4–9 in. across, pure white, open three or four days from 8 A. M. to 1 P. M.; petals broad, concave: seeds the largest of the genus. North central U. S. G. F. 1:366, 367; 6:416 (good). B.M. 6536 (poor). A luxuriant grower; when crowded or in shallow water the lvs. and fls. rise 4–6 in. above the water; spreads rapidly by tubers. Moderate bloomer.

44. Var. **màxima** (*N. odorata,* var. *màxima* of gardens). A form with round lvs. and closed sinus, the lobes curved out at apex to a short point; petioles pubescent, with long hairs, with a few faint longitudinal brown stripes: fls. medium to large, pure white, somewhat cup-shaped. Lake Hopatkong, N. J. Rather smaller than the type! Possibly a natural hybrid of *N. tuberosa* and *odorata.*

Garden Varieties of N. Tuberosa.

45. *Richardsonii,* Tricker (=var. plena). Fls. very double, pure white, standing well above the water; sepals and outer petals drooping. Int. by Geo. Richardson of Lordstown, Ohio, about 1894.—46. *ròsea,* Hort. Fls. pink, standing above the water, Probably N. tuberosa × N. odorata, var. rosea.

BB. *Lvs. crowded on the rhizome.*

47. **càndida,** Presl. (*N. biradiàta,* Sommerauer. *N. semiapérta,* Klinggraef). Similar to 48. Angles of attachment of sepals projecting; all the filaments broader than the anthers: fr. ovoid; seed large. Forms sterile hybrids with 48. Central and northern Europe.

48. **àlba,** Linn. Lvs. roundish, entire, floating, 4–12 in. across, red when very young: rhizome black: fls. white (in the type), 4–5 in. across, open from 7 A. M. to 4 P. M.; petals broad, ovate, somewhat concave; angles of attachment of sepals rounded; filaments of inmost stamens not wider than the anthers: fr. more or less spherical; seed small. Eu., Siberia.—A robust species.

49. Var. **ròsea,** Mast. (*N. alba,* var. *rùbra* = *N. alba,* var. *sphærocárpa* = *N. alba,* var. *Càsparii*). Outer petals rosy, intermediate ones intensely rosy, inmost petals with the filaments and processes of carpels deep red-brown; variable in purity of color. Fagertärn, Sweden; rare. B.M. 6736 (stamens poor). R.H. 1879:230.—Difficult to manage in this country.

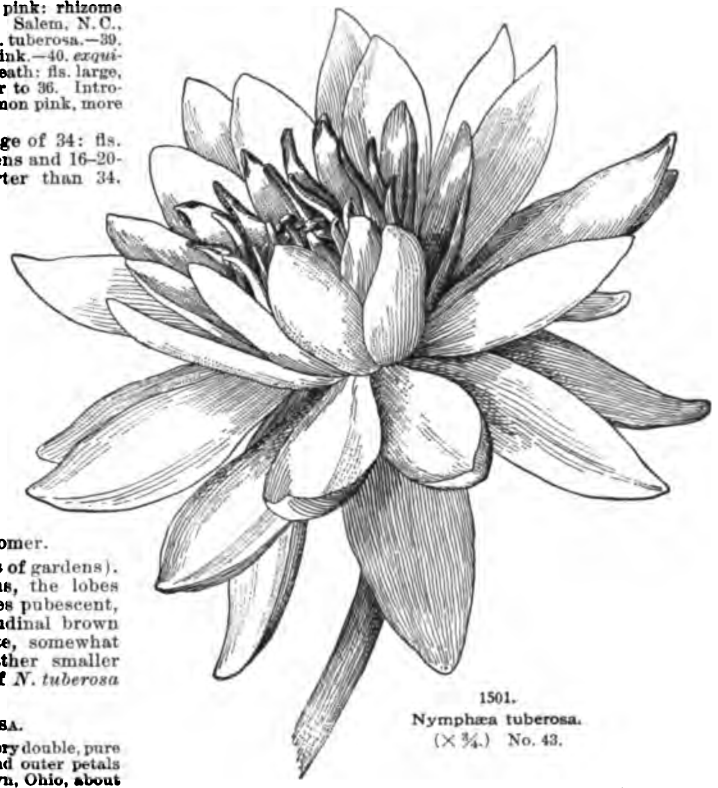
50. Var. **Frœ́belii,** Hort. A dark-fld. form of 49; also hard to succeed with in this country.

51. Var. **candidíssima,** Hort. (*N. candidissima,* Hort.). Lvs. orbicular; lobes strongly curved, overlapping; yellowish when very young: rhizome brownish, sometimes 3 in. through: fls. large, pure white, sterile. The first to bloom in spring, continuing until frost; very robust. Most desirable white variety.

Garden Varieties and Hybrids of N. alba and of N. alba, var. rosea.

FIRST GROUP.

52. ***Marliàcea,*** var. *àlbida.* Fl. large, dazzling white; petals narrow, numerous; stamens with a tendency to be flushed pink. Int. about 1889. Gn. 52:1147, p. 444.—53. *Gladstoniàna,* Tricker, is much like 52, larger and of more open growth. Int. by Geo. Richardson, Lordstown, Ohio, in 1898.



1501. Nymphæa tuberosa. (× ¾.) No. 43.

54. ***Marliàcea,*** var. *càrnea,* like 52 except in color, which is a soft flesh pink, deepening toward the base of the petals; fragrance of vanilla. Int. about 1889. 55. *Wm. Doogue,* like 54, but of more open growth: petals evenly colored, broader and more concave. Int. by Henry A. Dreer in 1899.

56. ***Marliàcea,*** var. *rosea.* Fls. large, deep rose color; young lvs. purplish red, changing to deep green. Int. about 1889.

SECOND GROUP.

57. *Làydekeri,* var. *rosea* (N. Laydekeri), with a thick erect rootstock, forming no offsets: fls. small, rosy pink, changing to purplish, opening about 11 A. M. Int. by Marliac about 1893; probably N. tetragona × N. alba, var. rosea.—58. *Làydekeri lilàcea* (N. liliacea = N. lilacina), color soft rosy lilac, with yellow stamens; odor of a tea rose: lvs. with occasional dark blotches. Int. in U. S. in 1895.

59. *Làydekeri,* var. *fulgens.* Petals concave, crimson pink: stamens dark red. Very brilliant. Int. in 1895.—60. *Làydekeri, purpùrata* (N. L. purpurea). Fl. rosy crimson; stamens orange red. Int. in 1895.

61. *lùcida.* Fls. large, rosy vermilion: lvs. blotched with reddish brown. Int. by Marliac in 1895.

62. *Róbinsoni* (N. Robinsoniàna). Fls. large, floating; a yellow ground color, overlaid with purplish red: lvs. blotched. May be N. alba, var. rosea × N. Mexicana. Marliac hybrid, introduced into U. S. in 1895. Gn. 52:1147.

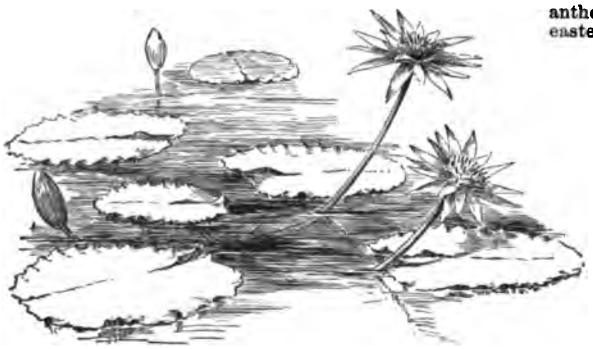
63. *fúlva* closely resembles 62: lvs. spotted brown above, red beneath. Int. by Marliac in 1895.

64. *Seignoréti.* Fls. delicate yellow shaded with rose and carmine; borne about 6 in. above the water: lvs. mottled. Probably N. alba, var. rosea × N. Mexicana. Int. by Marliac about 1897.

65. *Andreàna.* Outer petals dull, whitish at apex, red below; inner petals dull dark red: stamens bright orange: lvs. blotched; lobes overlapping. Shows blood of N. Mexicana. Int. by Marliac about 1897.

66. *Aurora.* Fls. rose-yellow on first day, becoming deep red on the third; general effect orange: sinus of leaf open. Int. by Marliac about 1897.

67. *Ellisiàna.* Fls. brilliant carmine purple. Int. about 1897. 68. *gloriòsa.* Very dark red; much like 67. Int. in 1899. 69. *James Gurney.* Fls. 5–6 in. across, dark rose color. 70. *Wm. Falconer.* Fls. 6–7 in. across, bright garnet color. (Nos. 69 and 70 resemble 67). Int. by Henry A. Dreer in 1899. 71. *Marliàcea,* var. *flámmea* (N. flámmea). Very similar to 67. Int. in 1895. 72. *Marliàcea,* var. *ígnea* (N. ignea). Similar to 67. Int. in 1895. 73. *Marliacea,* var. *rubra-punctata.* Fls. deep rosy purple, spotted carmine. Int about 1897. 74. *Sanguinea.* Similar to 73. Int. by Marliac in 1898.



1502. Nymphæa gracilis (× 1-12). No. 83.

SECTION II. APOCARPOUS NYMPHÆAS.

SUBGENUS V. BRACHYCERAS.

A. *Lvs. entire or slightly wavy at base.*

75. **élegans,** Hook. Lvs. narrowly peltate, orbicular to ovate, margin entire or with 5 or 6 small scattered teeth; under surface dark purple; diam. 7 in.: fls. pale violet, 3–6 in. across, open three days from 8 A. M. to 1 P. M.; buds ovate; sepals marked with black lines and dots; petals ovate, obtuse, 12–20; stamens stout, about 75, yellow; appendage a mere tip; filaments broad. Mex. B.M. 4604.

76. **cærùlea,** Savigny (*N. stellàta,* Caspary. *N. scutifòlia* of gardens). BLUE LOTUS OF EGYPT. Lvs. narrowly peltate, oval, entire or slightly sinuate at base; under surface green with dark purple blotches, purplish at margin, 12–16 in. across: fls. 3–6 in. across, open three days from 7:30 A. M. to 12 M.; buds conical; sepals thickly marked with black lines and dots; petals 14–20, lanceolate, acute, light blue above, lower half dull white; stamens 50–70; outer filaments broad, yellow: appendage long (three-sixteenths in. on outer stamens), pale blue. Egypt, northern and central Africa. Ann. Mus. Paris, vol. 1 (1802), p. 366 c.p. F.S. 7:653.—Free grower and bloomer but not showy.

77. **micrántha,** Guillemin & Perottet. Lvs. elliptic, entire in apical half, rest of margin sinuate; sinus deep; lobes spreading, much produced and acuminated, bearing bulbs which produce new plants at the top of the petiole! Under side of leaf green, tinged with purplish brown and minutely dotted: fls. small, white, 3–5 in. across; calyx pale green, unspotted; petals lanceolate and very acute. West coast of Africa. B.M. 4535.—Not yet introduced into America.

AA. *Lvs. distinctly or deeply sinuate.*

B. *Sepals spotted with blackish dots and lines.*

78. **pulchérrima,** Tricker. Lvs. somewhat peltate, orbicular-ovate, strongly sinuate, angle of lobes acuminate; under surface green, densely blotched with purplish black; margin purplish red; diam. 16 in.: fls. light blue, 10–12 in. across: buds sharply conical; petals 22, lance-ovate, whitish at base; stamens about 140, appendaged; filaments yellow, outer ones broad; appendage and back of outer anthers blue. Probably *N. Capensis* × *N. cærulea.* Raised by W. Tricker.

79. **stellàta,** Willd. (including *N. versícolor,* Roxbg. B.M. 1189). BLUE LOTUS OF INDIA. Lvs. elliptic-orbiculate, rather broadly peltate; margin irregularly repand-dentate; lobes hardly produced; green above; deep blue-violet beneath: fl. 3–7 in. across, pale blue (rarely pink or white), open three days from 8 A. M. to 2 P. M.; buds ovate; sepals with minute blackish dots; petals 11–14, dull white at base; stamens 33–54; appendage blue; anthers and filaments pale yellowish. Southern and eastern Asia. Andrews Bot. Rep. 5:330. B.M. 2058.

80. **ámpla,** DC. (not of gardens). Lvs. narrowly peltate, sub-orbicular, sinuate or nearly entire, with small black spots above and below, 6–15 in. across: fls. white, diam. 3–8 in.; sepals coriaceous, ovate-lanceolate, acute; petals 7–21, lance-ovate; stamens 30–190, outmost ones much longer than inmost. Texas, south to the West Indies and Brazil. Fl. Brasil, 77, p. 129 pl. 28–30. B.M. 4469.—Very near of kin to *N. gracilis.*

BB. *Sepals without blackish markings.*

81. **Capénsis,** Thunb. (*N. scutifòlia,* DC. *N. cærulea* B.M. 552 and American gardens). CAPE BLUE WATER-LILY. Lvs. rather narrowly peltate, orbicular-ovate, strongly sinuate-dentate, angle of lobes produced, acuminate; 12–16 in. across: fls. rich sky-blue, 6–8 in. across: open four days from 7 A. M. to 4 P. M.; buds ovate; sepals pure green outside, whitish within; petals 20–30, lower third nearly white, narrowly elliptic; stamens about 150 (97–221, Casp.); filaments yellow, outmost ones broad, inmost filiform; appendage and back of outer anthers blue. S. Africa. Andr. Bot. Rep. pl. 197. F.S. 6:645.—A very desirable species. 82. Var. **Eastoniénsis,** Ames (*N. stellàta,* var. *Eastoniénsis*). Fls. steel-blue; petals broader and more rounded than in the type, rather larger: lvs. longer, oval, more deeply toothed. Seedling from the type, raised by C. Blomberg, gardener to O. Ames, N. Easton, Mass., in 1896. G.F. 9:475.

83. **grácilis,** Zucc. Fig. 1502. Lvs. narrowly peltate, deeply and irregularly sinuate or nearly entire, suborbicular; angle of lobes rounded; under surface pure green (or suffused purple in hybrids), 15–17 in. across: fls. white, 6–8 in. across; sepals pure green; petals 16–20, acuminate; stamens about 60, deep yellow; outmost filaments short, broad, petaloid; anthers with long yellowish appendage. Mexico.

1503. Nyssa sylvatica (× ⅓).

Garden forms of *N. gracilis:* 84. *Wm. Stone* (and var. cærulea). Habit and form of 83: fls. large, open from early morning till evening; sepals green outside, blue within; petals dark blue, with a purplish cast; stamens very numerous. Doubtless a hybrid of N. gracilis and N. Zanzibariensis. Raised by W. Tricker, Riverton, N. J., 1899.—85. *Mrs. C. W. Ward,* like 84, except in color, which is a beautiful pink. A charming variety, exhibited by W. Tricker, in 1900.—86. *Mauvii,* "fls. delicate pale mauve, sweet scented;" seedling raised by S. Henshaw, at W. Brighton, N. Y., about 1892.—87. *Gréyæ,* a form of 83, raised by Benj. Grey, Malden, Mass., with blue fls. shading to white.

88. *Capensis* × *Zanzibariensis*. Lvs. somewhat peltate, orbicular-ovate, strongly sinuate, angle of lobes acuminate; under surface dark purple: 8–16 in. across. fls. rich blue, open 3–5 days, from 9 A. M. to 4 or 5 P. M., 6–8 in. across: sepals green outside, blue within; petals 15–20, narrow, acute; stamens 60–100; appendage blue. Cult. about Phila. Free bloomer, strong grower.

89. **Zanzibariénsis**, Casp. Lvs. somewhat peltate, orbicular or orbicular-ovate, margin closely sinuate-dentate; angle of lobes hardly pointed, under surface more or less suffused violet; diam. 8–15 in.: fls. 6–12 in. across, open three to five days from 11 A. M. to 5 P. M.; sepals green outside, margins purple, deep purplish blue within; petals 18–24, oblong, obtuse, deep blue; stamens 136–242, appendage dark blue; back of anther dark crimson-violet; outer filaments obovate, yellow. Zanzibar, B.M. 6843 (as *N. stellata*, var. *Zanzibariensis*). Gn. 25:431 (small). 90. Var. **azùrea**, light blue, and 91, var. **ròsea**, pink, are otherwise like the type, but open earlier in the morning; they come up promiscuously from seed of the type or of one another.

92. **Astræa**, Grey (*N. grácilis* × *N. Zanzibariénsis*). Leaves floating, with general habit of a strong-growing *N. gracilis*, green, tinged purple beneath. Fls. standing well above water, stellate, with a resemblance to *N. gracilis*, but much larger; sepals green, shading to yellow at base, the inner surface bright blue, shading through white to translucent at the base; petals blue, shading to white at base, usually about 17 in number; stamens less than 70, linear-lanceolate, yellow, tipped with blue-purple; stigma less than 20-celled, with blunt-toothed, yellow apices. Both parents hybridize freely either way, but the hybrid is sterile. Unites the American (Mexican) with the African species. Var. **ròsea**, Grey, is like the preceding, but the color is rose-pink instead of blue; it is hybridized with *N. Zanzibariensis rosea* instead of the type.

SUBGENUS VI. ANECPHYA.

93. **gigantèa**, Hook. Lvs. narrowly peltate, elliptic or ovate, margin sinuate-dentate, sinus open; under surface brownish pink, becoming purple; 18 in. across: fls. light blue to violet (rarely rose color or white), open seven days from 9 A. M. to 6 P. M.; diam. 6–12 in.; sepals pure green; petals very many, dark blue at tip, shading to nearly white at base; stamens 680–745; filaments mostly filiform; anthers bright yellow. Australia. B.M. 4647. F.S. 7:751.—The most delicate and lovely, and withal one of the largest of the genus.

HENRY S. CONARD.

NÝSSA (name of a water nymph; these trees grow in swamps). *Cornàceæ*. TUPELO. PEPPERIDGE. SOUR GUM. Tupelos are bold and picturesque, hardy deciduous trees, valued for the flaming scarlet of their autumn foliage and for the distinctness of their winter aspect. They grow in swamps and are usually 40–60 feet high, attaining a maximum of 100 feet. Old specimens often have a melancholy appearance by reason of the drooping habit of the lower limbs. The upper branches of a Tupelo are often twiggy, crooked or "kinky." The foliage is leathery, and as glossy as if varnished. Tupelos are hard to transplant from the wild, even when heavily pruned, because they have remarkably long roots with few rootlets. Nursery-grown trees that have been frequently transplanted are preferable, but seedlings are easily raised. Of the 7 species, 2 are natives of eastern Asia, the rest of North America. The only species offered by American nurserymen is *N. sylvatica*.

Nyssas are trees or shrubs with petiolate, usually entire lvs. and small fls. borne in short racemes or dense heads. Unlike the Dogwoods (Cornus), they belong to a group in which the fls. are unisexual, instead of hermaphrodite. From Aucuba and Garrya they differ in having alternate lvs. Nyssa is distinguished from its immediate allies by the following characters: petals of the male fls. none, or 4 to many, imbricated; stamens 4 to many: ovary 1-celled; style 1, simple or 2-parted.

1504. Pepperidge—Nyssa sylvatica.

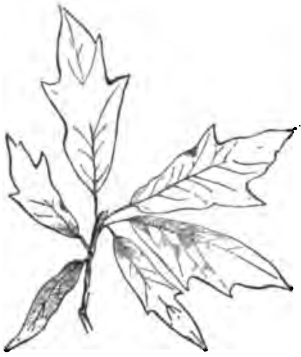
sylvática, Marsh. (*N. multiflòra*, Wang.). TUPELO. PEPPERIDGE. BLACK GUM. SOUR GUM. Figs. 1503–4. Lvs. usually entire, obovate or oval, mostly acute or acuminate, 2–4 in. long: staminate fls. in compound heads; pistillates larger, 2–14 together: fr. 3–7 lines long, nearly black, acid, with an ovoid stone, little flattened. Me. and Ont. to Mich., to Fla. and Tex. G.F. 3:491; 7:275. B.B. 2:547.

W. M.

O

OAK. Plate XXI. Strength, solidity, durability are symbolized in the Oak. The tree is connected with the traditions of the race, and it is associated with literature. It is a tree of strong individuality, with bold, free growth and massive framework. Its longevity appeals to every person, even though he has no feeling for trees. It connects the present with the past. It spans the centuries.

This feeling that the Oak represents a long span of years is itself the reason why we should consider the tree with veneration and let it live its full time; and this is the particular lesson which the writer would impress. Spare the isolated Oak trees! Of whatever kind or species, a mature Oak is beyond price. To allow it to remain bespeaks culture and kindly feeling.



1505. Variable foliage of the Oak.—Pin Oak type.

Many species of Oak are now available in nurseries. There are perhaps 25 species that can be relied on for planting in the northeastern states, and there are particular varieties adapted to almost every habitable part of North America. The planting of cheap, quick-growing willows and poplars is so common that one almost despairs of the time when such strong and expressive trees as Oaks shall be planted. There is little difficulty in the planting of Oaks if one secures nursery-grown stock. They grow more slowly than some other trees, but what they lack in rapidity of growth they make up in character and foliage color. If quick effects are wanted, some fast-growing tree may be planted with them, to be removed as the Oaks need the space. Some of the species grow nearly or quite as rapidly as hard maples, when young. Other species are mere bushes and make an excellent border-mass on the farther side of large grounds. Of such is the native Scrub-Oak (*Quercus ilicifolia*) of the eastern states. The native species are usually the best for any region, from the fact that they are adapted to climate and soil; and then, a feeling for common native plants is an indication of the highest appreciation and of the keenest response to the conditions in which one lives.

For a full sketch of the kinds of Oaks, see *Quercus*.

L. H. B.

Among the native deciduous trees of the eastern United States no kinds are more useful or attractive, either in economic value or for ornamental planting, than the various species of Oaks. Hardiness, longevity, beauty of foliage and fruit, exemption from the injurious attacks of disease or insect pests, and beauty, strength and durability of the lumber are among their especially valuable characteristics. The family of Oaks is a large one, but they mix and vary so much by natural hybridization and geographical variations that their botany is puzzling to all but the most astute scientific students. Casual observers and amateur botanists who attempt their study find them an interesting but difficult family to identify. A sprig from a tree which is probably a hybrid between the willow and Pin Oaks, Fig. 1505, is a fair sample of the kind of variations which are frequent in Oak forests. Experienced woodsmen, who are quite familiar with all the Oaks in their neighborhood, find that, a few miles from home, on different soil and elevation, they meet with varietal differences of bark, foliage, fruit and general appearance of trees which they can scarcely associate with the species as they have known them.

That Oaks have been esteemed and admired from time immemorial is evidenced by the numerous forms in which their leaves and fruit appear in all kinds of ornamentations in all ages.

Acorns of all species are objects of interest, but the larger forms, especially those of the Fringed or Mossy-cup Oak, are particularly attractive.

In autumn the foliage of Oaks remains green until many other trees have shed their leaves; then they assume rich shades of red, bronze and brown, presenting a splendor of ripening foliage less brilliant but not less beautiful than that which, a few weeks before, arrayed some of their forest companions so gorgeously.

It has been said that "Who plants Oaks, plants for posterity." Too often this has been interpreted to mean that Oak trees grow and develop so slowly that a planter may not reasonably expect to realize much benefit from his own plantings, but that long after he has passed away posterity will reap the harvest which he has sown. Judged from a lumberman's standpoint, this is nearly correct. The Pin Oak and some other species are mature at from 75 to 80 years of age, and seldom live more than 100 years, but the White Oaks are not fit for sawing into lumber until they have passed 125 years of age, and most of the large valuable trees are much older than this.

The White Oak, found naturally on low lands and clay soil, is unquestionably the patriarchal aristocrat among native trees of the eastern U. S. While it is a sorrowful fact that nearly all the tall forest Oaks with large trunks have fallen before the march of human progress, still there are a few venerable specimens left, with very large, spreading heads, but whose trunks are so short as to have little commercial value. These have undoubtedly stood for several centuries, and are still in unimpaired strength and vigor, being typical specimens of the natural development of their species when allowed time and room for growth in open clearings. One notable example is a White Oak in the Friends' graveyard in the city of Salem, N. J. Its trunk is 19 ft. in circumference 3 ft. from the ground, and its branches cover an area 118 ft. in diameter north and south, and 105 ft. east and west. Another specimen in North Mt. Moriah Cemetery, in Delaware county, Pa., in the suburbs of Philadelphia, measures 28 ft. 4 in. in circumference of trunk a foot above ground, and 22 ft. 4 in. at 3 ft. above ground, the branches spreading 96 and 106 ft. in diameter.

A few years ago one such white Oak was ruthlessly destroyed near South Glastonbury, Conn., by its vandal owner for the value of the fire-wood it contained. These trees were no doubt well established in the soil before Christopher Columbus discovered America. Such specimens are now so scarce it is a pity that they cannot be protected by law, and unappreciative owners be taught to regard such venerable trees for the pleasure which their presence affords to an intelligent public, if from no other motive. A fine old pasture Oak is shown in Fig. 1506.

1506. Field-grown white Oak.

Considered from a gardener's or planter's standpoint, the Oaks are among the most valuable of our native trees. An idea that they are very difficult to transplant and slow of growth, for many years almost barred them from cultivation, but experiments made within the past 20 years have done much to correct this popu-

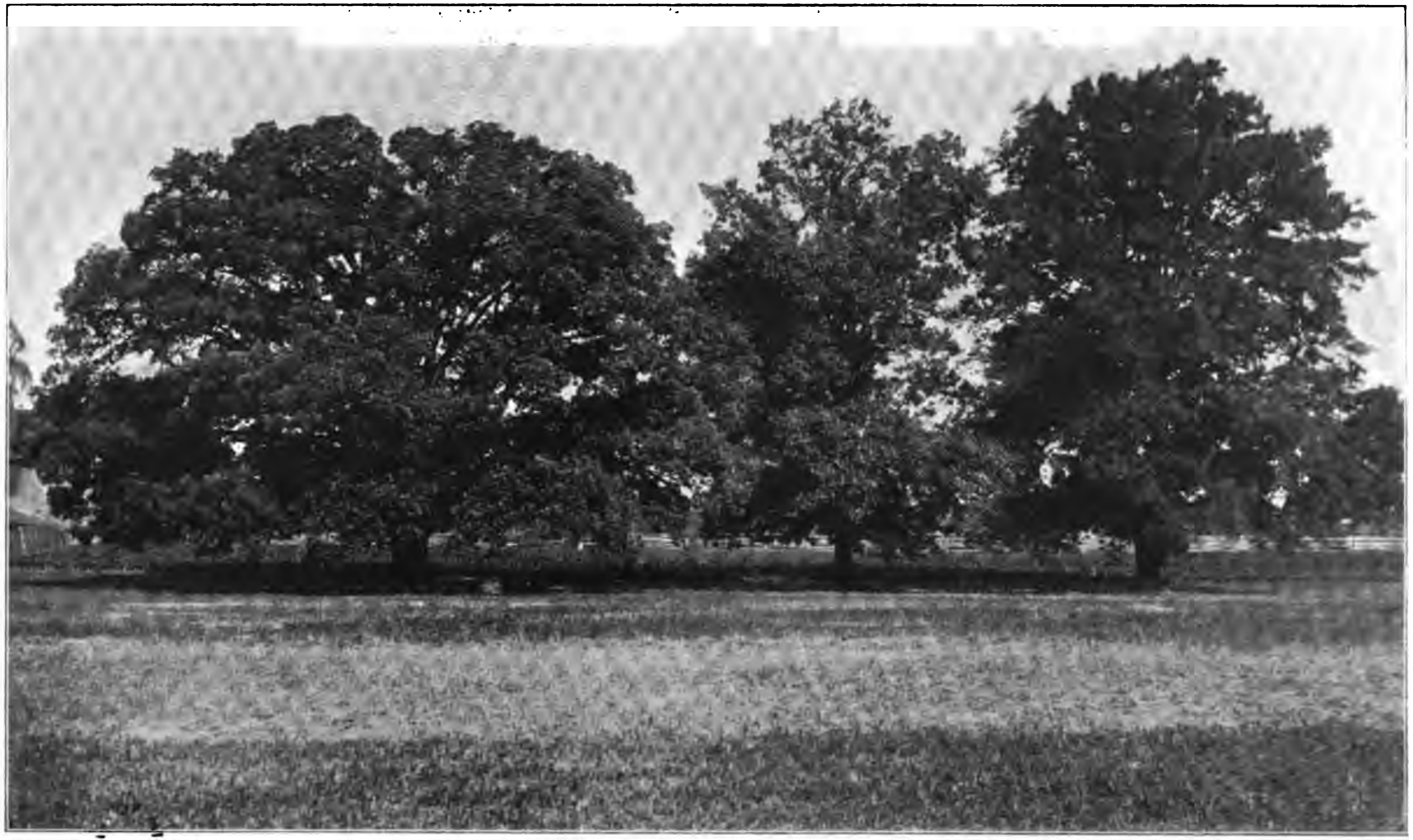


Plate XXI. Typical Oaks.

Quercus alba, the White Oak; *Quercus palustris*, the Pin Oak; *Quercus Phellos*, the Willow Oak, respectively. See p. 1111.

lar prejudice, and have shown that by using good trees and by giving proper subsequent care and attention, Oaks will grow as easily and develop as rapidly as many other species, and are very satisfactory. A Pin Oak in the grounds of the writer, about 65 years old, is more than 70 ft. in height, 60 ft. in spread of branches, and 11 ft. in circumference of trunk 3 ft. from the ground. A Swamp White Oak in the same lawn is about 50 years old, and is 50 ft. in height, 54 ft. in spread of branches and 7 ft. in circumference of trunk 3 ft. from ground. These trees are growing on a rich, sandy loam, which is well drained by a substratum of gravel and sand.

A notable object lesson in the use of Oaks in ornamental planting is found in Fairmount Park, Philadelphia, Pa. After the close of the Centennial Exhibition which was held there in 1876, the buildings were removed, the grounds cleared, and from 1880 to 1884 thousands of Oaks were planted in this section; a majority of them Pin Oaks, but interspersed with them White, Swamp White, Red, Scarlet, Black, Chestnut, Willow, Bur, Shingle, etc., as well as maples, ash, lindens, elms, poplars, buttonwoods and some others. These Oaks are now from 20 to 40 ft. high, and from 2½ to 3½ ft. in circumference measured at 3 ft. above the ground, and are equal or superior in size and development to most of the other trees, which were planted at the same time, excepting Carolina poplar and buttonwood. These trees are on level land and in heavy clay soil, which appears to be a favorite condition for most of the larger growing species of Oaks. Fig. 1507 may suggest an idea of the remarkable progress and development which these trees have made in from 16 to 20 years. There are few trees even among those which are considered fast-growing varieties that will show better measurements or more symmetrical developments at the same age.

If seedling Oaks are taken up when one or at most two years old, transplanted every three years, and well cultivated on good land, they will form fine trees, with root systems which can be moved with but little risk until they attain considerable size, but unless they have had such culture, the transplanting of any but very small trees is usually unsatisfactory. Attempts at moving trees which have stood too long without transplanting or which have grown without cultivation have generally resulted in failure, and such experiences have caused the prejudice which has prevented their more general use. Under favorable circumstances most Oaks are rapid growers, but unless conditions are favorable their roots do not become readily reëstablished in the soil after transplanting, and for this reason they are often slow to start into vigorous growth. For this reason judicious nursing, with plenty of manure and water and cultivation of the soil, will be abundantly rewarded by shortening the period of convalescence.

While many soft-wooded trees transplant more readily than Oaks and will grow more rapidly immediately after transplanting, still the Oaks will in time outgrow most of them, and will be in their prime when many of the companions of their youth are declining or gone. The best Oaks for planting in the northeastern and middle section of the U. S. are White, Swamp White, Mossy-cup, Scarlet, Pin, Red, Willow, Laurel or Shingle and Chestnut. Of these the Pin is at present the most popular, because it develops quickly a thick, compact head, forming a beautiful symmetrical tree while quite young; but after it is 25 or 30 years old the interior branches of this dense head begin to die and a tangled mass of dead brush soon accumulates. Unless this is removed (and it is not an easy task), it gives the tree a neglected and unsightly appearance. Other species of this type have this tendency also. The White and Chestnut Oaks and their allies have more spreading branches, are more open-headed, and are not subject to this objectionable characteristic, but they continue to increase in size, with unimpaired beauty and symmetry of form, for centuries.

Plate XXI shows a group of Oaks familiar to many who have traveled between Philadelphia and New York via the Pennsylvania railroad. The trees stand about 100 yards north of the railroad track in a field a quarter of a mile east of a small station called Andalusia, 7 miles west of Bristol. The large tree is a White Oak, measuring 15 ft. in circumference 3 ft. from the ground, with branches spreading 78 ft. in diameter. It is a typical specimen of the habit of this tree as it grows in open land. The middle tree is a Pin Oak probably 50 or 60 years old. It has several dead branches and is evidently declining. The next tree is a Willow Oak. They stand in heavy clay soil on rather low land, but not swampy. There are numerous fine specimens of Oaks in this locality, which for many years have attracted the attention of travelers. The Black Jack and Scrub Oaks, which as bushes and small trees cover large areas of the sandy belt stretching along the Atlantic coast from Long Island to Florida, and the Rock Chestnut and other species, which find subsistence on the steep and rocky hill-sides of the eastern states, do not often attain large size. Nevertheless their presence is of great economic value in covering barren wastes with vegetation, where few other trees can find enough to support life. In many other situations these dwarf Oaks are admirably adapted for producing desirable effects.

1507. Avenue of Pin Oaks.
Fairmount Park, Philadelphia, planted about 1884.

The "grand old Oaks of England" have been admired and venerated for centuries, but in this country the American Oaks are far superior to any of the European species, as they develop faster and are more enduring. *Quercus Robur*, which is the European species most commonly planted in this country, appears to be short-lived here, usually declining before it reaches 50 years of age.

Everywhere in the southern states the Live-Oak is popular (Fig. 1508). It is associated with every old plantation. It is the characteristic tree of the country from the Carolinas south and west.

Samuel C. Moon.

OAKÈSIA (Wm. Oakes, New England botanist). *Liliàceæ*. A genus of 2 species of American hardy perennial herbs, having the graceful habit of such choice wild flowers as the Solomon's Seal and more particularly the common bell-wort, *Uvularia perfoliata*. In moist woods it grows about a foot high and bears one or few pendulous, yellow, 6-parted fls. about ½ in. long. The 2 kinds can be transferred from the woods. *O. sessilifolia* is also offered by a few dealers in hardy plants. It prefers a rich light soil in a rather moist, partially shaded position, and improves greatly under cultivation.

The Oakesias can be easily told from Uvularias by their leaves, which are merely sessile instead of perfoliate, i. e., the base of the leaf does not surround the stem as it does in Uvularia. Oakesias were formerly placed in Uvularia, but in 1879 Watson removed them, largely because of the seeds, which are brown and nearly spherical in both groups, but in Oakesia they have a very much swollen, spongy, brown ridge, while in Uvularia they are covered by a thin white aril (an appendage growing from near the point where the seed is attached to the ovary). Other generic characters are: fls. few, solitary on short pedicels opposite the lvs.; segments without callosities: capsule membranous, elliptical, acutish at each end, very tardily dehiscent: lvs. more or less rough on the margins.

sessilifòlia, Wats. Stem once forked: lvs. oblong-lanceolate, acute at each end; margins minutely scabrous: capsule borne on a distinct stipe. Canada to Fla. and Ark. B.M. 1402. L.B.C. 13:1262. G.W.F. 16. D. 51.
F. W. Barclay and W. M.

OAT. *Avena sativa.*

OBELISCÀRIA. See *Lepachys.*

1508. The wide-spreading Live Oak of the South. (See Oak, page 1111.)

ÓCHNA (old Greek name for a wild pear, which some of these plants were thought to resemble in foliage). *Ochnàceæ. O. multiflora* is a cool greenhouse shrub cult. by a few fanciers for its remarkable appearance when in fruit. The fls. are yellow, appear in spring, and are borne to the number of 10–15 in racemes terminating short lateral branches. The blossoms are short-lived, but the calyx is persistent. Its 5 sepals are greenish in flower, but become a bright red in fruit. The receptacle increases until it becomes an inch or so thick, globular and bright red. Upon it are borne black seed-like bodies, which are the carpels. The red and black make a fine contrast. This rare plant is best prop. by cuttings struck in autumn. It is cult. in America, but not advertised.

Ochna is a genus of about 25 species of trees and shrubs from tropical Asia and Africa: lvs. deciduous, alternate, minutely serrate, leathery, shining: fls. yellow, rarely greenish, jointed to the pedicels; sepals 5, colored, imbricate, persistent; petals 5–10; stamens indefinite; anthers opening longitudinally or by pore-like slits: ovary deeply 3–10-lobed; lobes 1-celled, 1-ovuled; styles connate; drupes 3–10, sessile.

multiflòra, DC. Glabrous shrub, 4–5 ft. high: lvs. oblong-elliptical to oblanceolate-oblong: petals sessile: anthers as long as the filaments, opening longitudinally: sepals in fruit about 4 lines long. Upper Guinea.
G. W. Oliver and W. M.

Ochna multiflora is a remarkably handsome shrub for conservatory decoration. It is usually regarded as a stove shrub, but has done well with us in a greenhouse temperature of 55° (min.). It has a unique effect, and to be properly appreciated specimens should stand out. The drupelets are black, making a striking contrast with the enlarged red receptacle, at a glance reminding one of a spindle tree. In a good bottom heat, seeds germinate in a month, and make neat little plants in a year. We have not been so fortunate with cuttings. Unfortunately for us, cat-birds appropriated all the berries as soon as they became ripe. They entered through the open spaces in the annex to our conservatory.
T. D. Hatfield.

ÓCIMUM. See *Basil.*

OCOTILLO. *Fouquieria splendens.*

ODONTADÈNIA (Greek, *toothed glands*). *Apocynàceæ.* Here belongs the fine tropical yellow-fld. climber sold as *Dipladenia Harrisii,* which rivals in beauty the well known greenhouse Allamandas. The fls. are fragrant, about 3 in. across, funnel-shaped, with 5 rounded, spreading lobes, and are more or less streaked with red in the throat, at the base of the lobes, and on the back of the tube. The treatment which George McWilliam has given Dipladenias with such good results (see *Dipladenia,* Vol. I) should be attempted for Odontadenia, but *O. speciosa* perhaps grows at lower altitudes, and may require the treatment usually given to hothouse vines. All Odontadenias have yellow fls., while Dipladenias are yellow only in the throat.

Odontadenia is a genus of about 8 species of tall, shrubby, tropical American climbers: lvs. opposite: cymes loose, usually ample, rarely few-fld. and scarcely branched: calyx 5-parted, the lobes remarkably blunt or rounded; corolla-lobes twisted in the pointed bud, overlapping to the right and twisted to the left; stamens fixed at the top of the narrow part of the tube. The genus is distinguished from Dipladenia by the shape of the calyx-lobes and by the cup-shaped group of toothed glands below the pistil.

speciòsa, Benth. (*Dipladènia Hárrisii,* Hook.). Shrubby, branched climber: largest lvs. 10–15 by 4–5 in., oblong, tapering, scarcely leathery, feather-veined, often purplish beneath; petioles stout, scarcely 1 in. long: racemes axillary and terminal; pedicels red, often 1 in. long, curved downwards: corolla-tube with a roundish base about ½ in. long and thick, then suddenly constricted, then gradually widening into a funnel-shaped fl. Brazil, Guiana, Trinidad. B.M. 4825.
W. M.

ODONTOGLÓSSUM (Greek, *tooth-tongue;* in allusion to the crest on the labellum). *Orchidàceæ.* A genus of orchids embracing about 100 species, natives of the higher regions of the Andes from Mexico and Guatemala to Colombia and Bolivia. On account of their handsome flowers these plants are among the most favorite orchids of cultivators. *O. crispum* is one of the finest of all orchids.

Plants epiphytic, with short rhizomes and 2-lvd. pseudobulbs, often with sheathing leaves at the base: fls. in few- to many-fld. racemes or panicles arising from the base of the pseudobulb; sepals and petals spreading, free, or the lateral sepals rarely somewhat united at the base; base of the labellum ascending parallel to the column and sometimes adnate to the latter; lateral lobes small, often erect; middle lobe large, spreading, variously shaped; column clavate, narrowed at the base, longer than in Oncidium.

This genus is closely related to Oncidium and Miltonia, some of the species of the latter being generally cultivated as Odontoglossums. These two genera are easily distinguished from Odontoglossum by the labellum, which expands directly from the base of the column. There is perhaps no genus of orchids in which the species are more variable and more closely related than in Odontoglossum. Numerous varieties connect the species by intermediate links, and the occurrence of many natural hybrids makes the limitation of species in this genus almost impossible. However much this may add to the perplexity of the botanist, it gives the genus an additional horticultural value and interest resulting in the production of numerous garden hybrids and in the selection of many varieties, one species, *O. crispum,* having over a hundred named kinds.
Heinrich Hasselbring.

Odontoglossums follow the high western mountain ranges from southern Mexico to southern Peru, and usually grow at great altitudes. With few exceptions, they are found in extremely moist situations where the annual rainfall is excessive and the temperature more or less even and cool throughout the year.

The extreme heat of our summer interferes somewhat with the culture of Odontoglossums in America, especially those of the *O. crispum* section, and it is necessary to use every precaution during that season to insure success.

A lean-to or half-span roof structure of northern exposure, protected by a brick or stone wall on the south side, and with ample means of ventilation, is best suited to Odontoglossum culture. Moreover, it should be provided with rolling shades elevated on framework 18 or 20 in. above the glass, to afford abundance of light, free access of air and requisite shade, with the additional assistance of keeping down the temperature in summer. The interior is best fitted with solid beds, if possible, but benches of stone flags or wood covered with ashes or gravel an inch or two deep will answer very well.

These, with the floors, should be hosed down two or three times daily, to keep the house as cool and as moist as possible.

Ventilation is highly essential at all times, especially in dull or wet weather. When the atmosphere is overcharged with moisture, the quantity must be governed by outside conditions. Top ventilation is most satisfactory, because it allows the heated air to escape, gives less direct draft on the plants, and does not have the drying effect produced by side currents.

The temperature during winter should never rise above 65° F., even with mild sun heat, and may fall to 48° or 50° at night, or even lower, without injury; during summer it must be kept as low as the outside temperature will admit. Fire heat should be dispensed with as early as possible in spring.

Odontoglossums do well under pot culture, excepting a few, such as *O. Londesboroughianum* and *O. coronarium*, with long creeping rhizomes; *O. citrosmum*, which has pendulous flower-scapes, and some of the smaller growing species, such as the *O. Rossi* section, which are more easily cared for under basket culture.

Repotting should be attended to in October and November, never during the summer months. Chopped fibrous peat, live sphagnum and clean decayed leaves in equal quantity, well mixed together, afford a very satisfactory compost. About one-half of the pot space should be devoted to drainage of charcoal or broken potsherds. The plants should be firmly potted, leaving the surface slightly convex, thus elevating the base of the plant a little above the rim of the pot when finished.

The *O. crispum* section, which includes *O. Coradinei*, *O. gloriosum*, *O. cirrhosum*, *O. luteo-purpureum*, *O. Pescatorei*, and kindred species, require an abundance of water at all seasons; in fact, the compost should never dry out, and judicious light overhead syringing once a day is beneficial in bright weather, but on very warm days it should be applied in the evening, at the same time allowing free ventilation to ensure good atmospheric action. Weak liquid cow manure during the flowering period is also of assistance.

Species of the *O. grande* section do not require as much water at the roots as the *O. crispum* type; the compost should be allowed to dry out frequently. They are also benefited by a little sun during winter.

O. citrosmum is an exception to the genus as regards temperature, and should be grown 10° warmer. It does very well in the Cattleya department, enjoys a good supply of water at the roots at all seasons, and may be easily induced to flower freely by giving it a sunny location during winter.

Very few of the species can be satisfactorily propagated by division; the trade depends principally on fresh importation.

Among the worst enemies of Odontoglossums are slugs and the small shell snails. They destroy the tender flower-scapes, often attacking them even in the leaf sheath. A piece of cotton wrapped about the base of the pseudobulb will afford a means of protection, and many may be caught by distributing bits of apple, potato, or saucers containing dry bran freely among the plants. Look them over morning and evening with a lantern.

For other cultural notes on Odontoglossums, see Orch. Rev. 4:22. ROBERT M. GREY.

Cool Odontoglossums.—The management of the tropical Odontoglossums found in high altitudes is one of the most difficult and fascinating problems in orchid culture. Nearly all American collections of them have decreased and have had to be refreshed from the tropics. The collection of H. H. Hunnewell, at Wellesley, Mass., has long been noted, although it has decreased in the last twelve years. The undersigned has been asked to give an account of the methods by which F. L. Harris long maintained this fine collection with perhaps less decrease than in any other collection in the country.

The great problem, of course, with these plants is to keep them cool enough in summer. The difficulty will probably never be wholly solved until the advent of artificial refrigeration. Shading alone is insufficient. The best principle to take advantage of is the coolness produced by the rapid and excessive evaporation of water. An example is the wet rag wrapped around a canteen in a hot desert, which keeps the drinking water cool.

How to produce a great and constant evaporation is, then, the particular problem, and Mr. Harris' device was an exceedingly ingenious one. Back of his Odontoglossum house he had a brick wall covered with English ivy, and he had water dripping over the whole vine during hot weather. This gave him an extraordinarily large evaporating surface.

In general, it may be pointed out that the conventional water pan gives a relatively small evaporating surface. A gravel bed yields a far greater evaporating surface. As an illustration, the undersigned would cite his own experience at the Buffalo Botanic Garden. There was a house built for *Victoria regia* and other tender aquatics, which was unoccupied during winter. An attempt was made to utilize this space in growing palms. The water tank was boarded over for the palms, but the water below did not furnish enough atmospheric moisture for the palms, and they had to be removed. The trouble was that the water in the big tank, being colder than the air, actually acted as a condenser. The next winter the tank was again boarded over, but the water in the tank was drawn off and the floor covered with a 6-inch layer of gravel. The results were entirely satisfactory.

J. F. COWELL.

With Odontoglossums we have had good results the past season by using what we call the Cookson formula, recommended by Mr. Norman C. Cookson in the "Orchid Review" for May, 1899. The formula is as follows: Three ounces of potassium nitrate and 2 ounces of ammonium phosphate, dissolved in a 3-gallon jar of soft water. In watering any orchids when making their growth, or when flowering, 1 ounce of the solution is added to each gallon of water used. In the experience of the writer, the above mixture is the best food met with for cool orchids. In time it will probably bring the plants into such a vigorous state that they will be able to stand our hot summers without so much suffering.

A. J. NEWELL.

INDEX.

album, 27, 40.
Alexandræ, 34.
Andersonianum, 34.
Andersoni, 39.
apiatum, 34.
Ashworthianum, 34.
aspersum, 10, 24.
bellulum, 18.
Bictoniense, 27.
Bluntii, 34.
brevifolium, 2.
candidulum, 36.
castaneum, 15.
Cervantesii, 39.
cirrhosum, 31.
citrosmum, 40.
constrictum, 15.
Coradinei, 6.
cordatum, 26.
coronarium, 2.
crispatum, 8.
crispum, 34.
cristatum, 25.
Dawsonianum, 44.
Dayanum, 25.
decorum, 39.
Edwardi, 45.
Egertoni, 42.
Ehrenberghii, 43, 44.
facetum, 9.
Gouvilleanum, 34.
gloriosum, 13.
grande, 3.
grandiflorum, 6.
guttatum, 34, 36.
Hallii, 16.
Harryanum, 19, 20.
hastilabium, 28.
Hebraicum, 10.
hystrix, 8.
Insleayi, 4, 5.
Krameri, 37.
læve, 17.
latemaculatum, 14.
Lehmannii, 34.
leopardinum, 5.
Lindleyanum, 7.
Londesboroughianum, 1.
luteo-purpureum, 8.
macranthum, 4.
maculatum, 11, 34.
Madrense, 35.
majus, 39, 41, 43.
Mariæ, 34.
maxillare, 35, 36.
membranaceum, 39.
mirandum, 12.
nævium, 30.
nebulosum, 36.
Nevadense, 21.
nobile, 33.
odoratum, 14.
Oerstedii, 38.
pardinum, 1.
Pescatorei, 33.
pulchellum, 41.
punctatum, 40.
radiatum, 8.
ramosissimum, 29.
Reichenheimii, 17.
rosellum, 40.
roseum, 40.
Rossii, 43.
rubescens, 43.
Ruckerianum, 32.
Sanderianum, 22.
sceptrum, 8.
Schlieperianum, 4.
Schrœderi, 34.
splendens, 5, 27.
superbum, 6.
Trianæ, 34.
tripudians, 19.
triumphans, 23.
Veitchianum, 33, 34.
Wallisii, 18.

SYNOPSIS OF SECTIONS.

A. *Fls. yellow, variously spotted with brown, crimson, etc.*

Section I. Ground color of the labellum yellow. .... Species 1–14

Section II. Ground color of the labellum white, rarely pale yellow or changing to yellow. Species 15–28

AA. *Fls. white, sometimes shaded with rose or cream, never with a bright yellow or greenish yellow ground color.*

Section III. Plants not dwarf: fls. numerous, in branched panicles much exceeding the lvs.... .... Species 29–34

Section IV. Plants manifestly of dwarf habit: fls. few, in slender racemes, with the scape (and often the whole inflorescence) shorter than the lvs., rarely exceeding them.............Species 35–44

AAA. *Fls. dark purple.*

Section V. Fls. numerous, small, in large, branched panicles......................Species 45

SECTION I.

A. *Labellum reniform, larger than the rest of the flower*................ 1. **Londesboroughianum**
A. *Labellum oblong or fan-shaped, shorter than the sepals: apex rounded, emarginate, or acute: margin entire.*
B. *Apex rounded or emarginate.*
C. *Sepals sub-rotund*...... 2. **brevifolium**
CC. *Sepals oblong to lanceolate.*
D. *Column with 2 blunt auricles*.............. 3. **grande**
4. **Schlieperianum**
DD. *Column with 2 cirrhous teeth* .... 5. **Insleayi**
BB. *Apex acute*............. 6. **Coradinei**
7. **Lindleyanum**
AAA. *Labellum variously shaped, fimbriately toothed, and having a pectinate crest*........ 8. **luteo-purpureum**
9. **facetum**
AAAA. *Labellum triangular or triangular-oblong, long-acuminate*.......10. **Hebraicum**
11. **maculatum**
AAAAA. *Labellum lanceolate, cordate or hastate at base.*
B. *Column with rhomboid wings* ....12. **mirandum**
BB. *Column with 2 subulate awns at apex*.........13. **gloriosum**
14. **odoratum**

1. **Londesboroughiànum**, Reichb. f. Pseudobulbs roundish ovate, 1–2-lvd.: raceme 3–6 ft. long, bearing as many as 30 fls.: sepals oblong, undulate, apiculate; petals obtuse, apiculate, wider; both light yellow, with many abrupt, narrow, concentric brown markings: blade of the labellum extending beyond the sepals, over 1 in. across, light yellow, with few brown blotches at base. Autumn. Mex. I.H. 30:497. Gn. 16, p. 502. F.M. 1877:246.—A distinct plant resembling an Oncidium. Var. **pardinum**, Hort. Lip profusely dotted with brownish crimson. Gn. 16, p. 503.

2. **brevifòlium**, Lindl. (*O. coronàrium*, Hort.). Plants with leathery, ovate-oblong, spreading lvs. and erect racemes, about 1 ft. high, bearing 10–20 fls. 2–2½ in. in diameter: sepals subrotund-unguiculate, undulate: petals similar, smaller; labellum smaller than the sepals, cuneate-emarginate, yellow in front, marked about the column with yellow and purple, with a 3-toothed tubercle on the base. Colombia. I.H. 21:170. G.C. II. 24:177; III. 18:489; 19:79. G.M. 34:819; 38:127.

3. **gránde**, Lindl. BABY ORCHID. Fig. 1509. Pseudobulbs 2-lvd.: lvs. broadly lanceolate: scape few-fld., twice as long as the lvs.: sepals lanceolate, the lateral ones keeled, yellow, banded with rich reddish brown spots; petals oblong, broader, obtuse, subundulate, apex yellow; labellum almost rotund, apex slightly emarginate, yellow, banded and spotted with rusty blotches, and with a large-lobed tubercle on the claw. Autumn. Guatemala. B.M. 3955. F.S. 1:24–26. P.M. 8:49. Gn. 48, p. 219; 51:1105. G.C. III. 17:41 (abnormal fls.).—A magnificent species with half-drooping racemes a foot long, bearing few large, brilliantly colored fls. 5–6 in. in diameter. Fig. 1509 is redrawn from "The Garden."

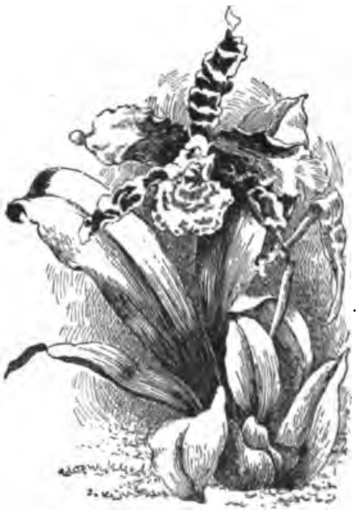
4. **Schlieperiànum**, Reichb. f. (*O. Ínsleayi*, var. *macrànthum*, Lindl.). Fls. on erect racemes, pale yellow, blotched and barred with deeper yellow mostly on the lower half of the segments. Autumn. Costa Rica. G.C. 1865:1082; II. 25:269. F.S. 17, p. 78.—Resembles a small pale *O. grande*, but fine for summer flowering.

5. **Ínsleayi**, Lindl. (*Oncidium Ínsleayi*, Barker). Lvs. leathery, oblong, shorter than the raceme: fls. 3½–4 in. across, yellow, spotted with brown, borne in a stiff, erect raceme; sepals and petals oblong, undulate, nearly equal; labellum shorter, ovate, retuse, sagittate and tuberculate at base, orange-yellow, spotted with reddish brown. Oct.–Dec. Mex. F.S. 1:49. Gt. 39, p. 474.—Free-flowering. Resembles *O. grande*. Var. **spléndens**, Reichb. f. Fls. larger, labellum and segments clouded with brown, yellow only at the tip. Gn. 25:428. G.C. II. 25:305. Var. **leopardinum**, Hort. A highly colored form. Segments pale yellow, heavily barred with chestnut-brown. R.B. 14:61.

6. **Coradínei**, Reichb. f. (*O. Lindleyanum*, Reichb. f. and Warsz. × *O. crispum*, Lindl.). A supposed natural hybrid with the habit of *O. crispum*. Raceme arching, few-fld.: fls. stellate, 3 in. across, dark sulfur color, with few chestnut-brown spots; sepals and petals oblong, acuminate, undulate; labellum shorter, oblong-acute, whitish, with a large oblong red-brown blotch near the center and several smaller ones on the disk; crest 3-toothed on each side. Resembles *O. triumphans*, but of more slender growth. Winter. Colombia. G.C. 1872:1068; II. 24:200; 25:269; III. 25:315.—Var. **supérbum**, Hort. A more robust var. with richly colored fls.: panicle much branched, 2 ft. long. Mexico. Var. **grandiflòrum**, Reichb. f. Fls. yellow, blotched and spotted with dark brown, large and handsome. Colombia.

7. **Lindleyànum**, Reichb. f. and Warsz. Lvs. linear: raceme lax: fls. 2–3 in. across, thin; sepals and petals yellow, blotched and striped with brown; lateral lobes of the labellum small, white, with purple spots; middle lobe red-brown, tipped with yellow. Spring. Colombia.—A variable species, supposed to be the parent of many hybrids.

8. **luteo-purpùreum**, Lindl. Lvs. ensiform, narrowed at base: fls. showy, 2–3 in. across, in a robust horizontal raceme; sepals ovate-oblong, undulate, brownish purple, with a yellow margin; petals similar, toothed and spotted with purple brown; labellum quadrifid, cordate or oblong, fimbriate yellow, spotted with purple and rose; crest on the claw pectinate. Winter and spring. Colombia. G.C. II. 21:585; 25:140.—Owing to its wide geographical scope, this species is extremely variable. A very mixed progeny has resulted from the crossing of this with other species, and the intermixture of the descendants. Var. **radiàtum**, Hort. (*O. radiàtum*, Reichb. f.). Sepals and petals narrow, yellow, heavily spotted with dark brown;



1509. Odontoglossum grande.

labellum expanded in front, white, shading into a brownish blotch at base. G. C. II. 25:76. Var. **crispàtum,** Reichb. f. Front half of the labellum convolute into deep folds, fimbriate. G.C. III. 5:233. Not advertised. Var. **scéptrum,** Reichb. f. Sepals creamy yellow, barred and washed with brown; petals broader-toothed, densely spotted with brown; labellum whitish. I.H. 18:73; 37:99. Not advertised. Var. **Hýstrix,** Hort. (*O. Hystrix,* Hort.). Labellum much fringed, and crests very spiny.

9. **facètum,** Reichb. f. (*O. Hállii* Lindl. × *O. luteo-purpùreum,* Lindl.). Natural hybrid. Sepals lanceolate, straight, light yellow, with very large cinnamon-colored blotches; petals lanceolate, straight, finely toothed, with numerous small spots; labellum almost circular, short, finely fringed, convolute, undulate, light yellow, with a semi-circle of radiating keels, some of which are fringed and in front of which is a horseshoe-shaped spot.

10. **Hebràicum,** Reichb. f. (*O. cristàtum,* Lindl. × *O. cirrhòsum,* Lindl.). Natural hybrid. Fls. 2½ in. across, borne in a panicle; sepals lanceolate; petals wider, undulate, all prettily marked, lemon-yellow, whitish in the center and spotted with red-brown markings suggesting Hebrew characters; labellum triangular or oblong, acuminate, erose-dentate, darker yellow toward the base, with a large maroon blotch and several smaller ones. Winter. Colombia. Gn. 21:339. G.C. II. 16:173. —Var. **aspérsum,** Rolfe. Differs slightly from the type in its lax racemes of golden yellow fls., blotched with purple-brown.

11. **maculàtum,** La Llave. & Lex Pseudobulbs ovate, 1-lvd.: lvs. lanceolate, acute, 6–8 in. long: raceme pendulous, loosely many-fld., longer than the lvs.: sepals narrowly linear or lance-oblong, acuminate, brown; petals ovate-lanceolate, acuminate, undulate, yellow, spotted with brown; labellum wide triangular, acuminate, crisp, yellow, brown-spotted, claw short, 2-crested: column white. Mexico. B.M. 6455 (not 4878, which is *O. cordatum,* Lindl.). B.R. 26:30.—Fls. freely in June. Racemes a foot long, with stellate fls. 3 in. in diameter. Var. **spléndens** and var. **supérbum** are recommended.

12. **mirándum,** Reichb. f. Lvs. lanceolate: raceme stiff, 1-sided: sepals and petals lanceolate-acuminate, almost wholly red-brown, with yellow margins; labellum linear-lanceolate, similarly marked, and having a few purple lines at base, callus horned: wings of the column rhomboid-serrate. Colombia.

13. **gloriòsum,** Linden and Reichb. f. Fls. pallid ochre, spotted with brown, paniculate; sepals and petals oblong-ligulate, acuminate; labellum lanceolate-acuminate, cordate at base, denticulate, about as long as the petals; claw with a 4-lobed, 4-toothed callus; column toothed below the middle. Colombia. G.C. 1865:578; II. 24:680.

14. **odoràtum,** Lindl. Pseudobulbs 2–3 in. long, narrowly ovoid, compressed: lvs. 1 ft. long, narrowly ensiform: panicle sometimes 2–3 ft. long, copiously branched and many-fld.: fls. 1½–2 in. across, dull golden yellow, blotched with brownish red; sepals and petals similar, narrowly lanceolate, acuminate, waved; labellum hastate, lateral lobes short, rounded; terminal lobe broadly subulate, narrowed, pubescent, waved; disk with 2 pairs of longitudinal, obtuse, erect teeth. Winter and spring. Mexico. B.M. 6502. G.C. II. 15:337. —Var. **latemaculàtum,** André. Fls. larger; spots purple-brown, larger and more intense. July, Aug. I.H. 17:39. Gt. 37, p. 492. Free-flowering.

SECTION II.

A. *Labellum more or less constricted in the middle, fiddle-shaped.*
B. *Column not winged, but having 2 projecting horns at the apex.* 15. **constrictum**
BB. *Column winged: wings pectinate or consisting of few decurved spines* .... 16. **Hallii**
BBB. *Column winged: wings toothed or entire.*
C. *Crest obsolete, 5-ridged* .... 17. **læve**
CC. *Crest falcate-pectinate* .... 18. **Wallisii**
CCC. *Crest of radiating keels toothed or entire* .... 19. **tripudians**
20. **Harryanum**
CCCC. *Crest a bifid callosity* .... 21. **Nevadense**
22. **Sanderianum**
AA. *Labellum with an ovate or oblong blade, often cordate at the base.*
B. *Lateral lobes not upright: labellum with a toothed crest* ...... 23. **triumphans**
24. **aspersum**
25. **cristatum**
BB. *Lateral lobes on the claw fleshy, upright: labellum with obtuse crest or none* .... 26. **cordatum**
27. **Bictoniense**
AAA. *Labellum hastate* .... 28. **hastilabium**

15. **constrictum,** Lindl. Lvs. linear-lanceolate, elongate: panicle long, slender, loosely branched: fls. 1–1¼ in.; sepals and petals nearly similar, oblong-lanceolate, acuminate, bright yellow, blotched with orange-brown; labellum fiddle-shaped, with rounded or truncate, apiculate blade, white, with a rose-colored blotch on each side, toothed. Small-flowered, but a profuse bloomer, often bearing 4–5 many-flowered panicles 1–1½ ft. in length. Venezuela. B.M. 5736.—Var. **castàneum,** Hort. Spots on sepals and petals covering nearly the entire surface. I.H. 35:66.

16. **Hállii,** Lindl. Lvs. a foot long, ensiform, narrowed at the base: scape 1–2 ft. long, with a many-fld. raceme of equal length: fls. 3 in. across; sepals and petals spreading, sub-similar, oblong-lanceolate, long-acuminate with recurved points, golden yellow, with transverse bands and spots of yellowish brown; labellum white, with a blood-red spot on the middle lobe and few spots on the lateral ones, erose-dentate, mid-lobe emarginate, with a short awn in the sinus, with 2 spinous crests on the claw. July. Ecuador. B. M. 6237. I. H. 18:58. F.S. 17, p. 81. G.C. 1865:962; II.25:140.—The spots on the labellum are sometimes scattered.

17. **læve,** Lindl. (*O. Reichenheimii,* Linden & Reichb. f.). Lvs. 6–10 in. long, oblong-lanceolate: sepals and petals oblong-linear, acute, plane, yellow, blotched with cinnamon; labellum smaller, white in front, violet on the upper half. Spring. Guatemala. B.M. 6265. I.H. 6:213. B.R. 30:39.—Plants bear 4–6 strict, stout panicles, 3 ft. long, with numerous fls. 2 in. in diameter. Not much esteemed.

18. **Wállisii,** Linden & Reichb. f. (*O. béllulum,* Hort.). Lvs. linear-lanceolate: sepals and petals ligulate, honey-colored, marked with brown streaks: labellum white, with a violaceous anterior part and marked with similar streaks at the base, with 3-falcate calli on the base. December. Colombia. I.H. 18:56; 38:127.—Elegant, with slender, drooping, mostly unbranched racemes, bearing few large flowers.

19. **tripùdians,** Reichb. f. and Warsz. Lvs. 7–9 in. long, linear-lanceolate: raceme stiff, erect, longer than the lvs., 8–10-fld.: fls. 2 in. across, dull yellow-green on the back; sepals oblong-acute or subacuminate, dark brown, with yellowish green tips and bases; petals similar, with yellowish bands; labellum short, panduriform, as long as the segments, white, with rose-colored blotches, with about 10 keels radiating from the disk; lateral lobes rounded, crenulate; central lobe subreniform, erose-dentate. Peru. B.M. 6029. F.M. 1876:208; 1880:407.

Var. **Harryànum,** Reichb. f. Sepals and petals almost blackish inside, tipped with light yellow, with a few similar marks at the base of the petal: labellum light yellow, with the base covered with rich mauve purple.

20. **Harryànum,** Reichb. f. Lvs. about 2, oblong-ligulate, obtuse, 6–12 in. long: raceme up to 3 ft. long, bearing 6–12 large fls.: sepals and petals ligulate-oblong, acute, wavy, brown with irregular, transverse, greenish yellow markings; the petals project forward; labellum large, flat, undulate, somewhat panduriform, lower half white, changing to yellow; upper half brownish marked with mauve lines and having about 7 serrated crests: column with 2 very small toothed wings. Colombia. Gn. 33:633. G.C. III. 2:169. Same as var. of No. 19?

21. **Nevadénse,** Reichb. f. Pseudobulbs ovate, acuminate: lvs. linear-lanceolate, base narrow, keeled: sepals and petals similar, lanceolate, long-acuminate, dark brown with a golden margin, outside dark green; limb of the labellum wide, hastate, deflexed, fimbriate, white-spotted; apex acute, subincurved, appendage on the claw bifid. Spring. Colombia. I.H. 17:45. Gn. 19, p. 425; 32, p. 589; 39, p. 250. G.C. II. 16:461; 24:201.—A showy plant, with slender, arching, 6–10-fld. panicles, and fls. 3–4½ in. across.

22. **Sanderiànum,** Reichb. f. Resembling *O. Nevadense.* Fls. stellate; sepals and petals lanceolate, acuminate, yellow, with numerous chocolate-brown markings; labellum cuneate, panduriform, apiculate, toothed, white or pale yellow, with a purple blotch in front; lateral lobes erect. Early spring. Trop. America.—Free-flowering.

23. **triúmphans,** Reichb. f. Pseudobulbs 3–4 in. long: lvs. oblong-lanceolate, 1–1¼ ft. long: scape arching, branched and many-fld., 2–3 ft. long: fls. 3–4 in. across; sepals and petals lance-oblong, subacuminate, undulate, yellow, blotched with deep crimson-brown; labellum ovate, cordate, acute, toothed and undulate, white with a roseate tip; crest of yellow or white teeth. March, April. Colombia. I.H. 16:609. G.C. 1867:516; II. 24:205; 25:141; III. 27:213 (var.). R.B. 18:121. G.M. 34:89. F. 1877:217.

24. **aspérsum,** Reichb. f. (*O. maculàtum,* La Llave & Lex. × *O. Rossii,* Lindl.). Natural hybrid. Lvs. oblong, acute: raceme few-fld.: sepals ligulate, acute, keeled, pale yellow, mottled with numerous brown blotches; petals oblong, acute, much broader, similar in color; labellum with a cordate, acute blade wholly whitish, callus, toothed, yellow, with brown lines, pubescent. Feb., March.—Free-flowering.

25. **cristàtum,** Lindl. Lvs. linear-lanceolate, a little shorter than the many-fld. scape: sepals and petals lanceolate-acuminate, yellow, spotted with brown; labellum oblong-lanceolate, white; apex and margin brown, with purple striæ, with a digitate crest on the disk; wings of the column semi-ovate or subquadrate. Peru. I.H. 17:21.—Var. **Dayànum,** Reichb. This is colored like the type, but the lip is rhomboid, apiculate, serrate, and the teeth of the crests on the labellum cross each other like the bristles on the nearly closed leaf of *Dionæa muscipula.*

26. **cordàtum,** Lindl. Pseudobulbs oblong, 1-lvd.: lvs. oblong, acute, 6–8 in. long: fls. large and handsome, with the sepals and petals yellowish green, richly blotched with brown; labellum cordate, acuminate, subcrenate, white, with a purplish crest at base and spotted with brown on the limb; sepals lance-linear, acuminate; petals broader and longer, undulate. Mexico. B.M. 4878 (as *O. maculatum*). I.H. 26:355. P.M. 13:147. Gn. 27:475. F.C. 3:100.—Stem 2–3 feet high; few or many-flowered.

27. **Bictoniénse,** Lindl. Pseudobulbs oblong, 2–3 in. long, 2–3-lvd.: lvs. 1 ft. long, ensiform, undulate, spreading: raceme 3 ft. long: fls. 1½ in. across; sepals and petals subequal, linear-lanceolate, greenish yellow, blotched with brown; claw of the labellum bilamellate, blade cordate, acuminate, undulate, white or roseate. Autumn. Guatemala. B.M. 3812 (as *Zygopetalum Africanum*).—This was the first Odontoglossum to reach England in a living state. It is free-flowering, but not as good as plants subsequently introduced. Var. **álbum,** Hort. Like the type, but labellum pure white instead of wine-red; sepals and petals brown. I.H. 19:91.

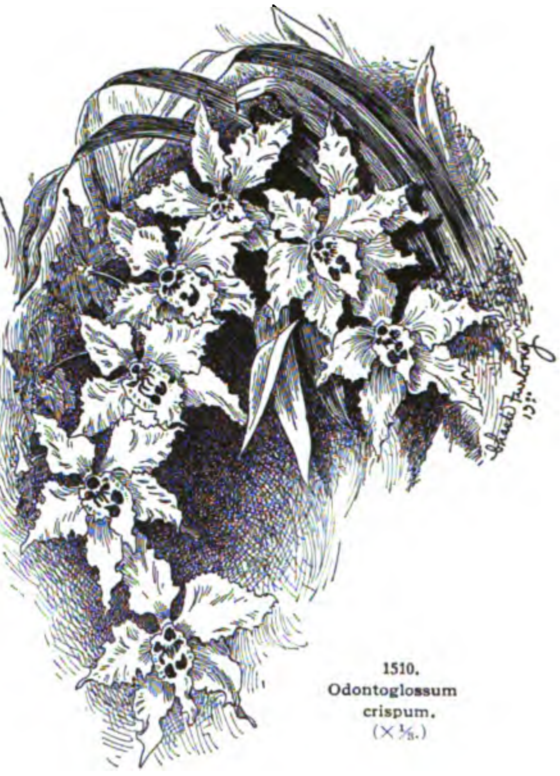
Var. **spléndens,** Ch. Lem. Labellum rose-lilac; other segments spotted. Seems to be like the type, with more pronounced color. I.H. 12:449.

28. **hastilàbium,** Lindl. Lvs. linear-oblong: scape 1½–2 ft.: bracts long, deciduous: fls. numerous, large, handsome, varied with pale green, purple and white, fragrant; sepals and petals spreading, lanceolate, very acuminate, pale green, with transverse purple dots and lines; labellum large, the lateral lobes forming 2 horns at base, the central one with a purple, crested claw, and orbicular-ovate, white, acute blade: column slender, winged, purple. Summer. Colombia. B.M. 4272.

SECTION III.

A. *Column without wings*........29. **ramosissimum**
AA. *Column with 2 spreading awns*.30. **nævium**
31. **cirrhosum**
AAA. *Column pluricirrhose: segments lanceolate*............32. **Ruckerianum**
AAAA. *Column with fimbriate or toothed wings: segments ovate or rhomboid*.................33. **nobile**
34. **crispum**

29. **ramosíssimum,** Lindl. Lvs. linear-oblong, acute, 1 ft. long: panicle much branched and many-fld., 2 ft. long: fls. 2 in. across, white, spotted with pale purple or violet; sepals and petals very undulate, narrowly ligulate, the latter wider; labellum rhomboid, acuminate, cordate at base, crested, tomentose. March, Apr. Colombia. J.H. III. 29:77. I.H. 40:170 (var. **cœléste,** Linden & Rod.).—A distinct and beautiful plant whose fls. have been likened to large spiders.



1510. Odontoglossum crispum. (×⅕.)

30. **nævium,** Lindl. & Paxt. Pseudobulbs oblong: lvs. thin, lanceolate: panicle erect, arching, much branched, bearing numerous star-shaped fls.: sepals and petals 2 in. long, narrowly lanceolate, beautifully crenate-undulate, white, profusely spotted with rose-purple; labellum shaped nearly like the petals, shorter and broader, with 2 large crests on the yellow base. May, June. Colombia. F.S. 6:594. G.M. 31:559.—Closely allied to *O. cirrhosum.*

31. **cirrhòsum,** Lindl. Pseudobulbs lanceolate, compressed, 2–3 in. long: lvs. 4–6 in. long, linear-ensiform, leathery: panicle often over 2 ft. long, drooping or inclined: fls. 3 in. across, snow-white, blotched with crimson or brown, base of the labellum yellow, with brown lines at the sides; sepals narrowly lanceolate, ending in long, curved points; petals wider; labellum two-thirds the length of the petals, with 2 ciliate lateral lobes and a narrow acuminate middle lobe. Apr., May. Ecuador, Peru. B.M. 6317. I.H. 25:301. Gt. 41:1383. Gn. 9, p. 401; 16, p. 19. G.C. II. 5:501, 503; 9:181; 25:12. F.M.

1876:222.—This species sometimes produces stout few-fld. stems, which should be cut to save the vigor of the plant.

32. **Ruckeriànum**, Reichb. f. Related to *O. crispum:* sepals and petals lanceolate, acute, creamy white, bordered with violet and spotted with brown, waved; labellum rather narrow, oblong, angular-lobed on each side of the base, yellow at base, with few chestnut-brown blotches; callus rhomboid serrate. Colombia. G.C. 1873:105; II. 24:204, 748 (var. *insigne*). J.H. III. 30:455 (var. *splendens*).

1511. Habit sketch of Odontoglossum crispum.

33. **nóbile**, Reichb. f. (*O. Pescatòrei*, Linden). Pseudobulbs ovate, bearing two strap-shaped lvs.: panicle 2–3 ft. long, diffuse, bearing numerous white, membranaceous fls. slightly tinged with rose: sepals ovate-oblong, slightly undulate; petals similar but much wider; labellum cordate-oblong, pandurate, with a yellow fimbriate crest and a few rose-colored spots. Spring. Colombia. F.S. 16:1624. I.H. 28:407. Gn. 21:330. G.C. II. 24:212; III. 3:245; 7:200; 25:69. A.F. 5:183.—A fine species producing numerous large, erect panicles. Var. **Veitchiànum**, Reichb. f. Like the type, but the parts of the flower have large, crimson-purple spots. Gn. 26:452.

34. **críspum**, Lindl. (*O. Blúntii*, Reichb. f. *O. Alexándræ*, Batem.). Figs. 1510 and 1511. Pseudobulbs ovate, compressed, about 3 in. long: lvs. linear, 1 ft. long: panicles rather short, but attaining a length of 2½ ft., with few short branches and crowded fls.: fls. white, variously spotted with crimson, brown, etc., or tinged with rose, 2–3 in. across; sepals ovate to ovate-lanceolate, often undulate; petals ovate to rhomboid, toothed and undulate-crisp; labellum oblong-ovate, fringed with teeth, wavy and crisp. Fls. are produced at any season of the year. Colombia. F.S. 16:1652. Gn. 4, p. 241; 20:291; 21, p. 95; 23, p. 210; 40, p. 596; 46, p. 149; 53, p. 297. R.B. 21:3. Gng. 6:24. J.H. III. 34:499. G.C. III. 21:363, 379; 23:165, 390; 25:67, 179, 187. A.F. 13:34. F.E. 9:327.—As was stated in the introduction, this species has probably more than a hundred named varieties. Many besides those cited have been figured in horticultural and botanical works. Very few varieties are found in American trade lists, but some of the most distinct are given below:

Var. **Andersoniànum**, Hort. (*O. Andersoniànum*, Reichb. f.). Fls. creamy white, with broad, longitudinal bands of cinnamon. F.M. 1872:45. G.C. II. 24:680, 681; III. 17:739.—Listed in America.

Var. **apiàtum**, Ballantyne. Fls. very large; sepals and petals laciniate on the edges, white, with rich chocolate-brown blotches. G.C. III. 15:375.

Var. **Ashworthiànum**, J. O'Brien. Fls. almost entirely rose-purple, with white margins and a few white marks on the sepals and petals. G.C. III. 19:197.

Var. **Gouvilleànum**, Ed. André. Fls. large, white; petals irregularly toothed, with few small crimson blotches; sepals heavily blotched. R.H. 1888:132.

Var. **guttàtum**, Hort. (*O. Alexándræ*, var. *guttatum*, Hook.). Sepals linear-oblong, with several pale purple blotches; petals broader, similarly spotted; labellum oblong-quadrate, contracted in the middle, spotted with rose and having a large rose patch on the disk. B.M. 5697.

Var. **Léhmannii**, Hort. Labellum broadly ovate, bright ruby red, broadly edged with white; crest yellow; sepals and petals tinged with rose, with few red spots. G.C. III. 24:147.—In American trade.

Var. **maculàtum**, Hort. Fls. white, spotted with purplish brown; petals suborbicular, laciniate-toothed. G.C. III. 16:248.

Var. **Mariæ**, Ed. André. Fls. pure white, except a few red spots on the base of the sepals. I.H. 25:325.

Var. **Schrœderi**, Hort. Fls. with 1 or 2 large and several small, brownish red spots on the white segments. Advertised in America.

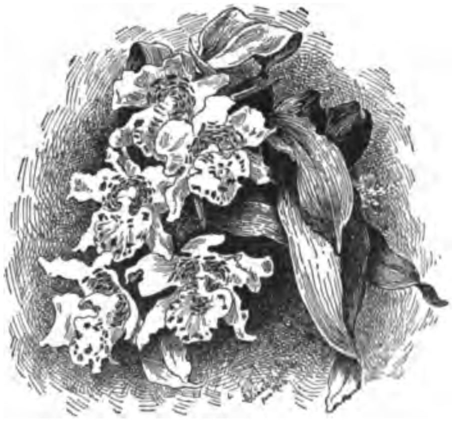
Var. **Triànæ**, Hort. (*O. Alexandræ*, var. *Trianæ*, Hook.). Dorsal sepals with a single roseate spot; lateral sepals suffused and spotted with rose; petals pure white; labellum with a large 2-lobed spot. B.M. 5691.

Var. **Veitchiànum**, Hort. Sepals ovate, undulate, white with several brownish crimson spots; petals broader, color like the sepals but mostly in one large central blotch; margins undulate and toothed. G.C. III. 1:799. F. 1884:177.

SECTION IV.

A. *Sepals and petals similarly colored.*
  B. *Column without wings.*
    C. *Pseudobulbs compressed and edged.*
      D. *Labellum white or colored like the petals*....................35. **Madrense**
      36. **nebulosum**
      DD. *Labellum violet*................37. **Krameri**
    CC. *Pseudobulbs smooth, terete*....38. **Oerstedii**
  BB. *Column with entire wings*.....39. **Cervantesii**
  BBB. *Column with toothed or crenate wings.*
    C. *Labellum reniform*..............40. **citrosmum**
    CC. *Labellum oblong-quadrate*.....41. **pulchellum**
    42. **Egertoni**
AA. *Sepals and petals dissimilar in color*........................43. **Rossii**
44. **Dawsonianum**

35. **Madrénse**, Reichb. f. (*O. maxillàre*, Hook.). Pseudobulbs long-ovoid: lvs. strap-shaped, 10 in. long: fls. 2½ in. across, 4–10 in a raceme; sepals and petals lanceolate, keeled, white, with a purple blotch at the base; labellum shorter than the sepals, the lateral lobes forming 2 acute recurved appendages on the claw, middle lobe trowel-shaped, white, with a yellow base and an orange blotch. Summer. Mexico. B.M. 6144. I.H. 30:480. F.M. 1875:158. Gn. 10, p. 443. G.C. II. 25:116 (seed pod). G.M. 39:117.



1512. Odontoglossum Cervantesii var. decorum (× ⅓).

36. **nebulósum**, Lindl. (*O. maxillàre*, Lindl.). Pseudobulbs 2–3-lvd.: lvs. oblong, acute, 9 in. long: scape about as long as the lvs., 5–6-fld.: fls. 3 in. across, pure white, with the bases of all the parts profusely spotted with brown; sepals membranaceous, oblong; petals similar but wider, all pubescent at the base; labellum with 2 large, erect lobes on the yellow claw; limb ovate, acute, dentate, pubescent. Mexico, at an elevation of 10,000 ft. I.H. 6:200. G.C. 1867:572 and II. 25:597. Not B.M. 6144, which is *O. Madrense.*—Var. **candidulum**, Reichb. f. Sepals and petals pure white, with a brown blotch and a few spots on the labellum. G. C. 1867:710; II. 25:596. Var. **guttàtum**, Reichb. f. Sepals and petals spotted to above the middle. I.H. 31:524.

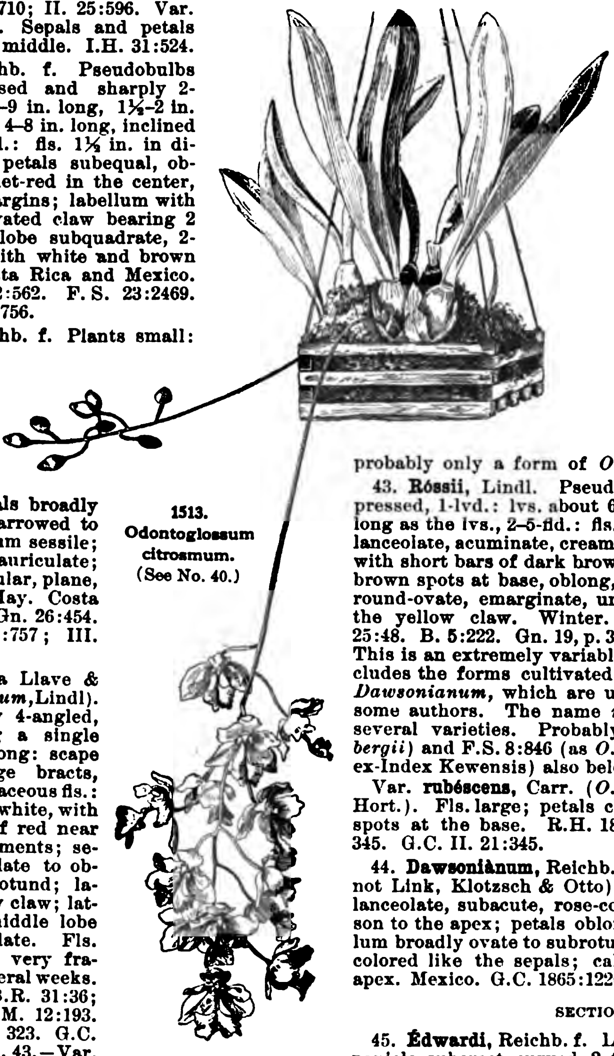
37. **Kràmeri**, Reichb. f. Pseudobulbs subrotund, compressed and sharply 2-edged, 1-lvd.: lvs. 7–9 in. long, 1½–2 in. broad, keeled: scape 4–8 in. long, inclined or pendulous, 3–5-fld.: fls. 1½ in. in diameter; sepals and petals subequal, oblong-acute, pale violet-red in the center, with broad white margins; labellum with a stout yellow excavated claw bearing 2 erect calli; middle lobe subquadrate, 2-lobed, pale violet, with white and brown streaks at base. Costa Rica and Mexico. B.M. 5778. I.H. 32:562. F.S. 23:2469. G.C. 1868:98; II. 25:756.

38. **Oérstedii**, Reichb. f. Plants small: lvs. linear-oblong, 4–5 in. long, narrowed to a petiole: raceme sub-erect, few-fld.: fls. 1½ in. across, white, with the base of the labellum golden yellow; sepals and petals broadly oblong, the latter narrowed to a short claw; labellum sessile; lateral lobes small, auriculate; middle lobe suborbicular, plane, deeply bifid. Feb.–May. Costa Rica. B.M. 6820. Gn. 26:454. G. C. II. 7:811; 25:757; III. 19:77.

39. **Cervántesii**, La Llave & Lex. (*O. membranàceum*, Lindl). Pseudobulbs usually 4-angled, 2 in. long, bearing a single oblong leaf 4–6 in. long: scape sheathed with large bracts, bearing 2–6 membranaceous fls.: fls. 2 in. across, pure white, with transverse streaks of red near the bases of the segments; sepals broadly lanceolate to oblong; petals ovate-rotund; labellum with a yellow claw; lateral lobes small; middle lobe large, broadly cordate. Fls. produced in winter, very fragrant and lasting several weeks. Mex. B.M. 4923. B.R. 31:36; 32:34. I.H. 1:12. P.M. 12:193. Gn. 19, p. 333; 32, p. 323. G.C. II. 15:753. F. 1881, p. 43.—Var. **màjus**, Hort. Fls. larger, with brighter spots. I.H. 25:313. Var. **décorum**, Hort. Fig. 1512. Fls. large, spotted inside and outside with bright red. I.H. 36:90. Gn. 32:617. J.H. III. 30:423. F.M. 1877:254. Var. **Ándersoni**, Hort. Fls. white; base of the sepals and petals barred with reddish brown; labellum bordered with spots of the same color. Mexico.

40. **citrósmum**, Lindl. Fig. 1513. Pseudobulbs subrotund, compressed, smooth, 1-lvd.: lvs. oblong, obtuse, thick, somewhat shorter than the raceme: scape pendent, 8–12-fld.: fls. large and full in outline, 3 in. across, white to rose, with a violet labellum; sepals and petals oblong, obtuse; labellum unguiculate, reniform. May, June. Guatemala. B.R. 29:3. R.B. 21:265. F.S. 6:633.

Var. **álbum**, Veitch. Fls. white, except the yellow claw of the labellum. Gn. 24:413. Var. **roséllum**, Lemaire. Fls. rose-colored, except the yellow claw of the labellum. I.H. 2:59. Var. **ròseum**, Veitch. Blade of the labellum deep rose. Var. **punctàtum**, Veitch. Fls. pale rose; sepals and petals spotted with purple. A variety called **máximum** is also advertised.


1513. Odontoglossum citrosmum. (See No. 40.)

41. **pulchéllum**, Batem. Pseudobulbs oblong, compressed, 2-lvd.: lvs. grass-like, rather stiff or rigid, 9–12 in. long: scape weak, 6–7-fld.: fls. white, except the yellow crest of the labellum; sepals ovate, acute; petals obovate, acute, somewhat undulate; lateral lobes of the labellum triangular, middle lobe oblong, subquadrate, apex recurved; column very short, with 3 fimbriate wings. Spring. Guatemala. B. M. 4104. B.R. 27:48.—Easily grown, and never fails to blossom. The flower-spikes suggest the lily-of-the-valley. Fragrant. Var. **màjus**, Hort. More robust than the type, with larger fls. Var. **grandiflòrum** is listed.

42. **Égertoni**, Lindl. Like *O. pulchellum*, but with the fls. only half as large: labellum acute, not almost truncate, excavated at the base and with 2 teeth inflexed over the excavation. Guatemala.—This is probably only a form of *O. pulchellum*.

43. **Róssii**, Lindl. Pseudobulbs small, much compressed, 1-lvd.: lvs. about 6 in. long: raceme about as long as the lvs., 2–5-fld.: fls. 2–3 in. in diameter; sepals lanceolate, acuminate, cream-colored to greenish yellow, with short bars of dark brown; petals white, with a few brown spots at base, oblong, obtuse, revolute; labellum round-ovate, emarginate, undulate, pure white, except the yellow claw. Winter. Mex. F.C. 3:129. B.R. 25:48. B. 5:222. Gn. 19, p. 306; 28:507. F.S. 20:2110.—This is an extremely variable species, and probably includes the forms cultivated as *O. Ehrenbergii* and *O. Dawsonianum*, which are united with this species by some authors. The name *majus* has been applied to several varieties. Probably I.H. 1:30 (as *O. Ehrenbergii*) and F.S. 8:846 (as *O. Ehrenbergii* = *O. apterum*, ex-Index Kewensis) also belong here.

Var. **rubéscens**, Carr. (*O. Rossii majus rubescens*, Hort.). Fls. large; petals clear rose, with dark brown spots at the base. R.H. 1886:492. Gn. 28:507; 39, p. 345. G.C. II. 21:345.

44. **Dawsoniànum**, Reichb. f. (*O. Éhrenbergii*, Hort., not Link, Klotzsch & Otto). Raceme few-fld.: sepals lanceolate, subacute, rose-colored, blotched with crimson to the apex; petals oblong, acute, pure rose; labellum broadly ovate to subrotund, crenulate; apex retuse, colored like the sepals; callosity with 2 teeth at the apex. Mexico. G.C. 1865:1226; II. 25:469. F.S. 17, p. 76.

SECTION V.

45. **Édwardi**, Reichb. f. Lvs. 2 ft. long, strap-shaped: panicle suberect, curved, 2 ft. long, the rachis bearing many horizontal branches covered with many rather small dark purple flowers: sepals and petals oblong to ovate-obtuse, reflexed and wavy; labellum tongue-shaped, obscurely lobed, with a prominent yellow lobulate callus on the disk. Spring. Ecuador. B.M. 6771.—A distinct plant, easily cultivated.

Supplementary list of synonyms and imperfectly known kinds: *O. Arnoldiànum.*—*O. blándum*, Reichb. f. Sepals and petals cuneate-lanceolate, acuminate, pale yellowish white, spotted with crimson-brown; labellum ovate, acuminate, crisp. Resembling O. næveum, with the labellum much broader. Winter and spring. Colombia. Fls. in a nodding raceme, creamy white, spotted with reddish purple; labellum white, spotted like the petals and stained with yellow at the base.—*O. Dawiànum.* Perhaps a misprint for Dawsonianum

—*O. delicàtum.*—*O. Edgertoniànum* is probably Egertoni.—*O. Karwinskii*, Reichb. f., is probably a synonym of O. læve.—*O. leopardìnum.* See No. 5.—*O. Phalænópsis*, Linden & Reichb. f.—Miltonia Phalænopsis.—*O. Rœzlii*, Reichb. f.—Miltonia Rœzlii.—*O. splèndens.*—*O. vexillàrium*, Reichb. f.=Miltonia vexillaria.—*O. Victoriense* and vars. album and superbum.—*O. Wárneri*, Lindl.—Oncidium Warneri.—*O. Warscewiczii*, Reichb. f.—Miltonia Endresii.—*O. Weltoni*, Hort.—Miltonia Warscewiczii.

HEINRICH HASSELBRING.

ŒCÓCLADES. See under *Dendrophylax.*

ŒNOTHÈRA (said to be Greek for *wine-scenting;* in allusion to the ancient use of the roots). *Onagràceæ.* EVENING PRIMROSE. Herbs, or sometimes shrubby at the base, with alternate simple or pinnatisect leaves and mostly showy fls., which are yellow, white or rose-color: calyx with a tube prolonged beyond the angled or cylindrical ovary, with 4 usually strongly reflexed lobes; petals 4, mostly obovate or spatulate; stamens 8, with narrow mostly versatile anthers: fruit a 4-valved loculicidal capsule. The Œnotheras are mostly dry-soil plants and are chiefly North American. Some of them are South American, and Bentham & Hooker admit one plant which grows in Tasmania. The genus is polymorphous, and there is consequently great difference of opinion as to generic bounds. What is commonly regarded as one genus is broken up into ten or a dozen genera by some authors. These minor genera are here treated as subgenera, for the group is fairly homogeneous from the horticultural point of view, and an entirely new set of names in several strange genera could scarcely be forced on the trade. The Godetia section contains some excellent flower-garden plants, and some of the true Œnotheras make glowing displays of yellow in the border; but the greater number of the species are of only secondary importance to the cultivator. Amongst the best of the border-plant species are *Œ. fruticosa*, var. *Youngii*, *Œ. glauca*, var. *Fraseri*, *Œ. cæspitosa*, *Œ. Missouriensis*, *Œ. speciosa.* For a botanical revision of the North American species, see Sereno Watson, Proc. Amer. Acad. Arts & Sci. 8:573 (May 13, 1873).

L. H. B.

There is nothing special to say about the culture of Œnotheras except to note the tender kinds and the biennials. All do well in ordinary garden soil, enjoying sunshine. They are easily raised from seeds and cuttings. *Œ. acaulis*, *eximia* (properly *Œ. cæspitosa*) are low-growing biennials which do well treated as annuals. They will not endure the winter. *Œ. Missouriensis* is a splendid trailer, with enormous yellow flowers, and seed vessels. It is quite hardy, and a fine rock garden plant. *Œ. biennis*, the common Evening Primrose, is rather weedy, and only fit for the wilder parts of the garden. *Œ. biennis*, var. *grandiflora*, is a better form. *Œ. fruticosa* and *Œ. Fraseri* are two of our best border kinds, with stiff, branching stems. *Œ. linearis* is a pretty little species, often naturalized but well worth growing. Childs' Mexican Primrose is tender, but makes a pretty plant for hanging pots. *Œ. speciosa* is a very fine species, but spreads so quickly by underground stems as to become a weed in favorable situations: it is good for naturalizing in wild grounds.

T. D. HATFIELD.

Œnothera is represented in Colorado by a diversity of specific forms which have been segregated into no fewer than six genera. Of these nearly all are perennial, *Œ. albicaulis*, Pursh, being an interesting exception. Of the perennials, *Œ. serrulata* will bloom the first season from seed, and probably some others will if sown early. A few kinds are slow to germinate, notably *Œ. brachycarpa* and *Œ. cæspitosa*, which usually produce some plants the first season, but most of the seeds remain dormant until the second year. *Œ. brachycarpa* includes two forms of specific rank, the typical form belonging to the western slope of the Rocky mountains and agreeing with Britton & Brown's description and illustration, but flowers 2 inches broad, seeds purplish black. The *Œ. brachycarpa* of the eastern slope, so called by botanists and collectors, has flowers 4 to 5 inches broad, capsule 1½ to 2 inches long (!), broadly winged, seeds larger than of any other species, of angular form, light brown. Foliage resembling that of *Œ. Missouriensis* and seems to be most nearly related to the latter species. The western type seems not to be in the trade.

As to culture, most sorts seem to prefer a porous soil with a rather large proportion of sand, an ideal soil consisting largely of decomposed granite with some vegetable matter. They seem to be quite adaptive, and *Œ. brachycarpa*, *Missouriensis*, etc., are found sometimes in stiff clay soil. An abundance of sunshine is natural to most sorts.

D. M. ANDREWS.

INDEX.

acaulis, 17.
albicaulis, 7.
amœns, 20.
biennis, 5.
bifrons, 20.
bistorta, 2.
brachycarpa, 19.
cæspitosa, 18.
Californica, 8.
cheiranthifolia, 3.
Childsii, 15.
Drummondi, 6.
eximia, 18.
Fraseri, 10.
fruticosa, 11.
glauca, 10.
gloriosa, 21.
grandiflora, 5, 21.
Lamarckiana, 5.
Lindleyi, 20.
linearis, 12.
macrocarpa, 9.
major, 11.
marginata, 18.
Mexican Primrose, 15.
Missouriensis, 9.
Nivertiana, 20.
ovata, 1.
pinnatifida, 7.
pumila, 13.
purpurea, 20.
quadrivulnera, 22.
riparia, 12.
rosea, 16.
roseo-alba, 20.
rubicunda, 20.
serrulata, 4.
speciosa, 14.
taraxacifolia, 17.
tetraptera, 15.
Veitchiana, 2.
vinosa, 20.
Whitneyi, 21.
Youngii, 11.

A. *Stigma capitate or disk-like, entire .....*
  B. *Calyx-tube filiform* ....I. TARAXIA, below.
  BB. *Calyx-tube short, obconic or funnelform.* II. SPHÆROSTIGMA, below.
AA. *Stigma deeply 4-cleft or at least 4-toothed.*
  B. *Stamens of equal length.*
    C. *Calyx-tube shorter than the ovary.......* III. MERIOLIX, p. 1120
    CC. *Calyx-tube usually much exceeding the ovary.*
      D. *Seeds angled, horizontal in the pod .....* IV. ONAGRA, p. 1120
      DD. *Seeds not angled, ascending.*
        E. *Fls. yellow, erect in bud: seeds in 2 rows in each locule.....*V. ŒNOTHERA, p. 1120
        EE. *Fls. white or pink, drooping in bud: seeds in 1 row............*VI. ANOGRA, p. 1120
  BB. *Stamens of unequal length.*
    C. *Anthers versatile.*
      D. *Plant caulescent (with stem).*
        E. *Fls. yellow.*
          F. *Seeds crested........*VII. MEGAPTERIUM, p. 1120
          FF. *Seeds not crested........*VIII. KNEIFFIA, p. 1120
        EE. *Fls. white, pink or reddish.............* IX. HARTMANNIA, p. 1121
      DD. *Plant stemless.*
        E. *Capsule with wrinkled wing-angles.....* X. PACHYLOPHUS, p. 1121
        EE. *Capsule with plane or entire wing-angles....................*XI. LAVAUXIA, p. 1121
    CC. *Anthers attached at base, erect or nearly so.....................* XII. GODETIA, p. 1121

I. SUBGENUS TARAXIA. *Stemless, usually perennial: stigma capitate: calyx-tube filiform: capsule sessile, narrow to ovate, usually not winged: fls. yellow.*

1. **ovàta,** Nutt. Perennial, slightly pubescent: lvs. ovate to lance-oblong, 8 in. or less long, acute, serrulate: calyx-tube sometimes 4 in. long, the petals less than 1 in. long and yellow: fl.-bud erect: capsule ½ in. long. Calif.

II. SUBGENUS SPHÆROSTIGMA. *Stem-bearing: stigma capitate: calyx-tube short, inversely conic or funnelform: capsule sessile, linear, not winged: fls. various.*

2. **bistórta,** Nutt. One to 2 ft., the base decumbent, hairy and pubescent: radical lvs. spatulate to lanceolate and petiolate, dentate: stem lvs. mostly sessile-ovate to narrow-lanceolate and about 1 in. long, dentate: fls. yellow, turning green, the petals (about ½ in. long) usually with a brown spot at the base: calyx-tube 1–3 in. long: capsule ¾ in. or less long, 4-angled, contorted. S. Calif.

Var. **Veitchiàna,** Hook. More slender: radical lvs. narrow-oblanceolate and long-petioled: capsule longer and narrower (1–1½ in. long) and little contorted. S. Calif. B.M. 5078.

3. **cheiranthifòlia,** Hornem. Stems decumbent or ascending, 2 ft. or more tall, canescent: lvs. thick, about 1-2 in. long, broad-ovate to lanceolate or the lower ones spatulate, the upper ones becoming sessile, most of them entire: petals yellow, ¼-⅓ in. long: capsule ¾ in. or less long, curved, somewhat hairy. Calif. B.R. 12:1040.

III. SUBGENUS MERIOLIX. *Stem-bearing: stigma disk-like but 4-toothed: calyx-tube shorter than the ovary, enlarging upward: capsule linear or nearly cylindrical, sessile: fls. yellow, axillary.*

4. **serrulàta,** Nutt. Slender, simple or branched, about 1 ft. high but variable in stature, nearly glabrous to canescent: lvs. linear to lanceolate, 1-3 in. long, usually acute, attenuate to the base, sharply dentate: petals broad-obovate, ¼ in. long, wavy-margined. Minn., west and south. Biennial or perennial. Mn. 7:41.

IV. SUBGENUS ONAGRA. *Stem-bearing: stigma 4-cleft: calyx-tube elongated and cylindrical, enlarging at the throat: capsule linear-oblong to long-conic, 4-angled: fls. yellow, opening in evening.*—TRUE EVENING PRIMROSES.

5. **biénnis,** Linn. COMMON EVENING PRIMROSE. Fig. 1514. Tall, strong, simple or branching biennial (often 4-5 ft.), closely pubescent or somewhat hairy: lvs. lanceolate to oblong to ovate-lanceolate, often 6 in. long, acute, remotely denticulate, the lowest ones petioled: calyx-tube 1-2 in. or more long: petals bright yellow, ¾ in. or less long: capsule pubescent or hairy, often 1 in. long. Generally distributed, and now a common weed in the Old World. Gn. 26, p. 480.—The fls. open suddenly at nightfall. It is a weedy plant and has little to recommend it to cultivation, although it is offered by dealers. In France the thickened roots are mentioned as an edible vegetable, to be used after the manner of salsify or vegetable oyster. The root should be eaten, according to Vilmorin, "at the end of the first year of its growth."

Var. **grandiflòra,** Lindl. (*Œ. Lamarckiàna*, Ser.). Fls. much larger, the petals 1-2⅓ in. long. Very showy when the fls. open. Commoner westward. B.M. 2068. B.R. 19:1604. Gn. 26, p. 482; 46, p. 64.

1514. Capsules of evening Primrose (× ⅓).

V. SUBGENUS ŒNOTHERA. *Stem-bearing: stigma deeply 4-cleft: calyx-tube very long and filiform or linear: capsule narrow-cylindric, obtusely 4-angled, with numerous seeds in 2 rows in each locule: fls. yellow, mostly showy.*

6. **Drúmmondii,** Hook. Fig. 1515. One to 2 ft., from an oblique or decumbent base, loosely pubescent: lvs. lance-oblong or oblanceolate, acute, either gradually or abruptly tapering into a short petiole, entire or slightly toothed: calyx-tube usually 2 in. long and very narrow: fls. 2-3 in. across, nocturnal, bright yellow, showy: capsule 1-2 in. long. Texas. B.M. 3361.—Perhaps biennial, but grown as an annual.

VI. SUBGENUS ANOGRA. *Stem-bearing: stigma deeply 4-cleft: calyx-tube elongated and enlarging upwards: capsule oblong or linear: fls. white or pink, opening by day.*

7. **albicaùlis,** Pursh (*Œ. pinnatífida*, Nutt.). Low (1 ft. or less tall), stems white and shreddy, the branches ascending, slightly pubescent or sparsely hairy: lvs. lanceolate, oblanceolate or lance-oblong in outline, deeply pinnatifid or some of the larger ones only strongly toothed, 4 in. or less long, sessile or nearly so: fls. large (3 in. or less across), diurnal, white and fading to rose, the petals obcordate. Prairies, west. B.R. 14:1142 (as *Œ. pallida*).

8. **Califórnica,** Wats. (*Œ. albicaùlis*, var. *Califórnica*, Wats.). Smaller and hoary-pubescent or villous, the stems only 3 or 4 in. long: lvs. narrow-oblanceolate and acuminate, usually stalked, toothed or pinnatifid: fls. often larger, fragrant, the petals lobed. Central and southern Calif.

VII. SUBGENUS MEGAPTERIUM. *Stem-bearing: stigma 4-cleft: calyx-tube very long and slender, enlarging at the top: capsule very broad and strongly 4-winged: fls. yellow, showy.*

9. **Missouriénsis,** Sims (*Œ. macrocárpa*, Pursh). Low, with a hard base, the ascending stems usually not over 1 ft. long, usually pubescent: lvs. thick, varying from oval to linear to narrow-lanceolate, 5 in. or less long, acuminate, narrowed to a petiole, entire or remotely denticulate: petals 1-2⅓ in. long, very broad, yellow: capsule 2-3 in. long and nearly as wide, broad-winged. Mo. and Neb. to Tex. B.M. 1592. Gn. 26, p. 480. R.H. 1857, p. 598.

VIII. SUBGENUS KNEIFFIA. *Stem-bearing: stigma deeply 4-lobed: calyx-tube very slender, somewhat dilated at the top: capsule rather small, club-shaped, 4-angled or narrowly 4-winged: fls. yellow, diurnal.*

A. *Plant more or less glaucous, glabrous.*

10. **glaùca,** Michx. Erect perennial, 2-3 ft.: lvs. ovate to ovate-oblong, 4 in. or less long, acute or somewhat obtuse, sessile, remotely denticulate: fls. large, in short leafy clusters, the calyx-tube about ¾ in. long; petals an inch long, more or less emarginate: capsule oblong, broad winged, short-stalked. Va., Ky., and south. B.M. 1606.—Var. **Fràseri,** Torr. & Gray (*Œ. Fràseri*, Pursh), is a form with ovate-lanceolate often slightly petioled lvs. Southern states. B.M. 1674.

1515. Œnothera Drummondii (× ⅓).

AA. *Plant not glaucous, usually hairy or pubescent.*

11. **fruticòsa,** Linn. SUNDROPS. Perennial (or sometimes biennial), erect and more or less branchy, rather stout, 1-3 ft. high, the terete usually reddish stems somewhat villous: lvs. ovate to narrow-lanceolate, 3 in. or less long, firm, usually acute, remotely denticulate or entire, mostly sessile: fls. 1½-2 in. across and showy, in an elongating cluster, with linear bracts: capsule oblong to obovate, short-stalked or sessile, strongly winged. Dry soil, Nova Scotia, south and west. B.M.

332.—Very variable. Var. **Yoùngii** (*Œ. Yoùngii*, Hort.) is common in cultivation, and is prized for its stocky growth and profusion of bloom. It is a strong, larger-leaved plant, with firm, shiny, slightly glaucous foliage, and bearing many bright lemon-yellow flowers: 2 ft., much branched and somewhat decumbent at base. Excellent. Var. **màjor**, Hort., is a strong-growing floriferous form, forming a dense bush-like specimen.

12. **lineàris**, Michx. (*Œ. fruticòsa*, var. *lineàris*, Wats. *Œ. ripària*, Nutt.). Usually lower and more slender: lvs. linear to narrow-lanceolate: capsule mostly less broadly winged, clavate. Conn., south. Gn. 26, p. 481.

13. **pùmila**, Linn. Slender, erect biennial: lvs. oblanceolate or oblong, usually glabrous, entire, the radical spatulate: fls. an inch or less across in a loose, leafy spike or raceme, the calyx-tube shorter than the ovary, the petals obcordate: capsule mostly clavate, short-stalked or sessile. Nova Scotia, south.

IX. Subgenus Hartmannia (*including Xylopleurum, etc.*). *Stem-bearing: stigma 4-lobed: calyx-tube funnelform, often very long: capsule club-shaped or obovate, broad-winged: fls. white, pink or red, diurnal.*

A. *Plant canescent or villous, usually erect, or at least prominently ascending.*

14. **speciòsa**, Nutt. Perennial, with a rootstock, erect or ascending branches, 2 ft. or less high, canescent: lvs. linear to lance-oblong, 4 in. or less long, remotely or sinuately dentate, or the lower ones pinnatifid, attenuate at base: calyx-tube as long as the ovary; petals large, obcordate, white: capsule ½–¾ in. long, 8-winged, acute at top. Mo., W. and S. B.M. 3189. Gn. 26, p. 482.

15. **tetráptera**, Cav. Villous: capsule larger and more broadly winged, very abruptly contracted at top: calyx-tube shorter than the ovary: fls. white, becoming rose. Texas, south. B.M. 468. Var. **Childsii** (*Œ. ròsea Mexicàna*, Hort.) is a handsome form introduced from Texas by John Lewis Childs in 1892. It was found in the wild. "We first secured the pink," Mr. Childs writes, "and afterwards someone else sent us the white, blush and the other shades, all from Texas." In some respects it differs markedly from *Œ. tetraptera*, and it is not impossible that it is a distinct species. In cultivation it is a trailing plant. The lvs. tend to be broader and less pointed than in *Œ. tetraptera*. It does not produce seed in the North, but is readily propagated by cuttings. It is an excellent plant either for the flower garden or for pots in the conservatory. It is popularly known as the "Mexican Evening Primrose."

16. **ròsea**, Ait. Root biennial or perennial: stem erect or ascending, 1–2 ft., branching from the base: lvs. lanceolate to narrow ovate-lanceolate, mostly acuminate, rather abruptly narrowed to a petiole, entire or remotely denticulate or the larger ones small-lobed at the base: calyx-tube shorter than the ovary: fls. small, fuchsia-like, purple or rose, the petals rounded and entire: capsule like that of *Œ. speciosa*. Texas and New Mexico, south. B.M. 347.—Offered by seedsmen.

AA. *Plant glabrous or essentially so, nearly stemless or else prostrate.*

17. **acaùlis**, Cav. (*Œ. taraxacifòlia*, Hort.). Tufted perennial or biennial plant, at first stemless, but producing prostrate, somewhat zigzag stems: lvs. oblong in outline, 5–8 in. long, petioled, divided into many unequal narrow divisions (like a dandelion leaf): fls. usually opening white, but changing to rose, large (2–3 in. across), the very slender tube 3–5 in. long: capsule short-obovate, broadly triangular-winged above. Chile. B.R. 9:763. Gn. 26, p. 480.—A very interesting plant.

X. Subgenus Pachylophus. *Stemless or essentially so: stigma 4-cleft: calyx-tube very slender but enlarging upwards, longer than the ovary: capsule with wrinkled or contorted wings: fls. white or pink.*

18. **cæspitòsa**, Nutt. (*Œ. exímia*, Gray. *Œ. marginàta*, Nutt.). Crown 2–4 in. high, perennial or biennial: lvs. clustered, oblong to narrow-lanceolate or spatulate, sometimes 1 ft. long, attenuate, repand-toothed, pubescent: fls. white or pink, 1⅛–3 in. across, the petals obcordate; calyx-tube 2–6 in. long: capsule oblong-pointed, 1–2 in. long. Neb., west and south. B.M. 1593, 5828. Gn. 26:469; 47, p. 46.

XI. Subgenus Lavauxia. *Stemless or essentially so: calyx-tube very slender, enlarging upwards, longer than the ovary: capsule with plane or entire wings: fls. white, pink, or even pale yellow.*

19. **brachycárpa**, Gray. Perennial, densely pubescent: lvs. thickish, ovate to very narrow-lanceolate, about 6 in. long, long-stalked, entire or notched or lyrately pinnatifid: calyx-tube 2–3 in. long; petals about 1½ in. long, purplish: capsule ovate, often 1 in. long, the wings not wrinkled. Kansas, west and south.

1516. Godetia amœna.
G. rubicunda splendens of the trade (× ¾).

XII. Subgenus Godetia. *Stem-bearing: calyx-tube short and usually broad: capsule ovate or linear, 4-sided, not winged: fls. lilac, purple or rose, showy.*

The Godetias are very showy garden annuals, with brilliant pink or red-purple flowers of satiny luster. They are generally of easy culture in any warm garden spot, although sometimes subject to what appears to be a disease of the root. They are excellent subjects for pot culture, either under glass or in the open. The garden forms are derived from two species.

20. **amœ̀na**, Lehm. (*Œ. Líndleyi*, Dougl. *Œ. ròseo-álba*, Hornem. *Œ. bìfrons*, Lindl., not Don. *Œ. purpùrea*, Hort., not Curt. *Godètia rubicúnda* and *G. vinòsa*, Lindl. *G. Lindleyàna*, Spach. *G. Nivertiàna*, Goujon). Fig. 1516. Rather small, often slender, small-leaved, the lvs. usually linear to narrow-lanceolate or

small-oblong, entire or nearly so: fls. 1–1½ in. across, white or rose or light-purple, rarely conspicuously spotted in the throat, scattered on leafy branches: stigma lobes about 1½ lines long: capsule 1½ in. or less long, tapering at both ends, on a pedicel ½ in. or less long, the seeds in one row in each locule. Pacific coast, from Vancouver Island southward. B.M. 2832. B.R. 17:1405, 22:1856, 1880. R.H. 1872:430.—The common old-time garden Godetia, and much given to dwarf forms. One of the best forms is known in the trade as *Godetia rubicunda splendens* (Fig. 1516). A common form is known as Bijou. There are double forms.

1517. Œnothera Whitneyi.
Godetia Whitneyi of the trade (× ⅓).

21. **Whitneyi,** Gray (*Œ. grandiflòra,* Wats., not Hort. *Godètia grandiflòra,* Lindl. *G. Whitneyi,* Moore. *G. gloriòsa,* Hort.). Stouter, broader-leaved, compact in growth: fls. 2–4 in. across, light purple, with dark purple spot at the throat on each petal, borne in a short, dense, not leafy spike or raceme; stigma lobes 3 lines long: capsule about 1 in. long, oblong or linear, the seeds in two rows in each locule. N. Calif. B.M. 5867. B.R. 28:61. R.B. 21:193.—The large-flowered Godetia of gardens, giving rise to such varieties as Lady Albemarle, Duke of Fife, Duchess of Fife, Duchess of Albany, Grandiflora maculata, Brilliant.

22. **quadrivúlnera,** Dougl. (*Godètia quadrivúlnera,* Spach). A very slender species 1–2 ft.: lvs. linear or nearly so, sessile, or with a very short, narrowed base, entire or nearly so: fls. about ½ in. across, purple, with eroded petals; stigma-lobes short: capsule ⅓–¾ in. long, 2-ribbed at the alternate angles, sessile, with seeds in 1 row. Calif. B.R. 13:1119.—Once offered by Orcutt.

Œ. splèndens, "light yellow," appears in trade lists, but its identity is unknown to the writer. The name splendens is also commonly used for a form of Godetia amœna. L. H. B.

OHIO, HORTICULTURE IN. Fig. 1518. Ohio lies in nearly a square body, about 200 miles from north to south and the same from east to west. The surface is undulating, being somewhat hilly in some portions, particularly in the southeast and along the Ohio river, and quite level in the northwestern part of the state.

There are no great elevations nor large bodies of water in the interior to modify the climate. Lake Erie, on the north, exerts considerable influence for some distance along its shores, but there are no wide climatic variations between different parts of the state. The range in temperature is considerable, sometimes reaching 98° in summer and falling as low as 30° below zero in winter, although such extremes seldom occur in the lake region. Some of the more tender fruits and ornamental plants often suffer because of low temperatures, but all horticultural products which can be grown in the same latitude are successfully cultivated within the state. The annual rainfall is about 38 inches, and severe droughts seldom occur.

Ohio has great horticultural possibilities, none of which are fully developed, but along some lines the limit seems to be almost reached; at least until wider markets are opened. The market for Ohio's horticultural products is mostly within the borders of the state, the most notable exceptions being grapes, strawberries and celery, these articles being shipped to other states in large quantities. The outside trade in nursery products is also considerable, the exports of trees and plants being much more than the imports.

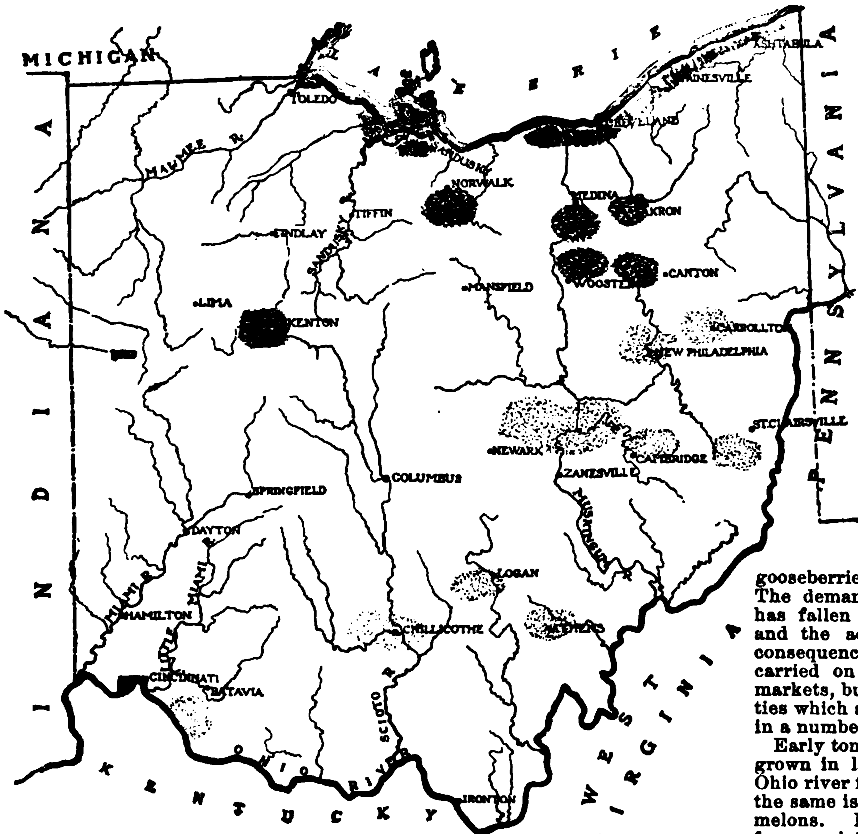
To the awakening of interest in horticulture and dissemination of horticultural knowledge, much is due to the efforts of such men as Kirtland, Warder, Elliot, Bateham, Campbell and Ohmer. The first united efforts of early horticultural workers was in the organization of the Ohio Pomological Society, in 1847. The name was afterward changed to the Ohio State Horticultural Society. This organization remains active at the present time, and during the entire period of its existence has numbered among its members many of the foremost horticultural workers in the state. Its influence has been widely felt, both directly through its members and publications, and indirectly through the county and local societies, a number of which are offspring of the state society.

The State University and State Experiment Station have, in recent years, exerted a decided influence on the horticulture of the state in helping to a better knowledge of plant diseases and insects, and to methods of controlling them, as well as in special horticultural work, pertaining to methods, varieties, etc.

Anything like a complete statistical review of the horticultural products of the state would be impossible, for such statistics have not been gathered for all crops. Statistics of this kind have only a transient value, however, and hence may well be dispensed with, except in a few cases where comparisons need to be made.

Apples are grown in all parts of the state, and, while some sections are better adapted to apple culture than others, there can hardly be said to be any well-defined apple belts within its borders, as shown by the orchards planted. There are commercial orchards in all parts of the state where alluvial soils abound, except in limited areas of the northwest. But few large orchards are found in any part of the state. Orchards exceeding 50 acres in extent are rare. The apple crop of the state is of considerable commercial importance, however, as shown by the fact that it often reaches a total of 17,000,000 bushels. Owing to the fact that the majority of the orchards are not planted for commercial purposes, much of the fruit produced is inferior in quality. Commercial orchardists, however, are giving considerable attention to spraying and other necessary details in orchard management, and are securing very satisfactory results.

Although the state is but little more than 200 miles across from north to south, there is a notable difference in the varieties of winter apples grown in the extreme northern and southern portions. The Baldwin is the leading variety in two or three tiers of counties lying along the lake; Rhode Island Greening finds a congenial home in this section also, and the Northern Spy in the northern tier of counties. None of these varieties is satisfactory below the central portion of the state. Rome Beauty is the leading sort in the southern part and is most at home in the counties lying along the Ohio river. Ben Davis is well adapted to the same section also. The Willow Twig is very satisfactory along the river in the eastern part of the state. Grimes Golden, Jonathan, York Imperial, and Hubbardston are found to be very satisfactory winter sorts in nearly all parts of the state. Of early varieties, essentially the same sorts are grown in all sections.



▨ Areas of largest peach production.

▩ Areas of largest celery and onion production.

■ Areas of largest grape production.

1518. Ohio, to show horticultural regions.

The conditions for successful peach culture are more favorable along the shore of Lake Erie than any other part of the state. Ottawa county is the center of peach culture in this section, Catawba Island taking the lead. In this locality the vineyards have been almost wholly replaced by peach orchards. The same state of affairs exists in a less marked degree on the adjacent islands and peninsula. Athens, Muskingum and Coshocton counties, in the southern and central parts of the state, produce large quantities of this fruit also. There are about half a dozen other counties in which peach culture is made a special feature of fruit-growing, but the industry is not developed to the extent that it is in those above named. In 1896 the total peach crop of the state was nearly 2,000,000 bushels, and of this Athens, Muskingum, Coshocton and Ottawa counties produced more than one-fourth. Mountain Rose, Oldmixon, Elberta, Smock, and Salway are the varieties most commonly grown.

There are no large areas of pear, plum and cherry production in the state, although a considerable number of cherry orchards have been planted near Clyde, in Sandusky county. Japan plums have not generally proved reliable. Red June, Burbank and Chabot have proved the most satisfactory of any. None are reliably hardy. Of grapes, there are about 15,000 acres within the state, nearly all of which are along the lake shore and on the islands near Sandusky, Cuyahoga county taking the lead with about 4,000 acres of vineyards. Owing to low prices of grapes, plantings have been limited in recent years, but not many vineyards have been destroyed, except to give place to peach orchards. Concord, Worden, Delaware and Catawba have been planted more than any others.

Small fruits sufficient for the home demand are grown in nearly all sections, but the shipping trade is less than formerly; hence the acreage devoted to these fruits has fallen off in some localities. The total acreage has not fallen off, but there has been an increase rather, and the cultivation of these fruits has become more general. In both area and product strawberries take the lead, followed by black raspberries, blackberries, red raspberries, currants and gooseberries, in the order named. The demand for black raspberries has fallen off considerably of late, and the acreage has decreased in consequence. Market-gardening is carried on mostly to supply local markets, but there are a few specialties which are grown on a large scale in a number of localities.

Early tomatoes and cucumbers are grown in large quantities along the Ohio river for northern markets, and the same is true, to a less extent, of melons. Large celery and onion farms exist in Hardin, Huron, Medina, Wayne, Cuyahoga, Summit and Stark counties. Reclaimed swamps consisting of muck are used for this purpose. In Ross county the growing of onion sets has become a large industry, the soil in this case being alluvial.

Several pickling establishments are in operation in various parts of the state, and for these are grown many thousands of acres of cucumbers and cabbage. A number of canning factories are found within the state, and these take the products of large areas of tomatoes and sweet corn. Fruit is not used in the canneries very largely, nor are peas, except in a few cases.

Vegetable-growing under glass is practiced in or near nearly all towns of a few thousand inhabitants. The business has assumed very large proportions near Toledo, Cleveland and Ashtabula. In nearly all cases greenhouses of the best form of construction are used, and are mostly heated by hot water. About Cincinnati, hotbeds are more common than elsewhere. This is the center of radish production, but lettuce is the leading crop in greenhouses. The houses are occupied with the crop from September until May, and about the middle of February tomatoes or cucumbers are planted in the lettuce beds. These crops are in bearing during May and June. Tomatoes and cucumbers are seldom grown as winter crops, as lettuce is more profitable and more easily grown in midwinter than either of the others. Grand Rapids lettuce is grown almost exclusively.

Floricultural establishments are found in all parts of the state, in most localities the products being for the home demand only, but large concerns at Painesville, Calla, Springfield and Dayton have an immense shipping trade of plants, the mailing trade being particularly large. Cut-flowers are grown in considerable quantities also, the principal centers being Cleveland and Cincinnati. Large nursery centers exist at Painesville, on the lake shore, and in the Miami valley, near Dayton and Troy. The stock grown in these and other nurseries of the state consists mainly of fruit trees and small fruit plants. Ornamental trees and plants are grown in comparatively limited quantities, for the reason that landscape gardening and ornamental planting have not been given due attention. More or less pretentious park systems are in a state of development in some of the larger cities, Cincinnati, Cleveland and Toledo leading in this respect. A number of cemeteries show considerable care in maintenance and some skill in planting, but well-arranged private grounds are rare. Spring Grove cemetery, in Cincinnati, was one of the first large landscape cemeteries in the world. Mount Auburn, in Cambridge, was the first rural cemetery in this country. See *Landscape Gardening* and *Strauch*.

While landscape art is in a rather backward condition within the state, there is quite a fund of accumulated knowledge regarding the adaptability of species and varieties of trees and plants to this climate. It would be too broad a statement to say that foreign species do not succeed here, but so many have been disappointing that there seems to be little of any value left. Fortunately there is an abundance of suitable material in our own and neighboring states.

Ohio is a great agricultural state, and this fact has somewhat retarded horticultural development, but, on the other hand, large manufacturing interests have had, and will continue to have, the opposite effect, and Ohio will in the near future take high rank as a horticultural state.

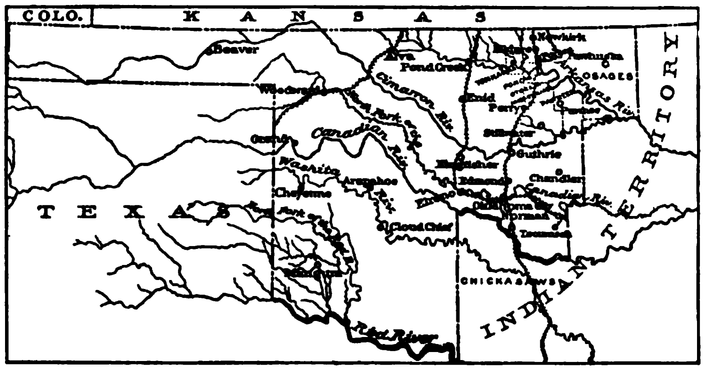
W. J. GREEN.

OKLAHOMA, HORTICULTURAL POSSIBILITIES OF. Fig. 1519. The northern boundary of Oklahoma is 37° north latitude. The southern boundary is an irregular line, but does not extend far south of the 35th parallel. Except a small strip which extends to the 103d meridian, most of the territory lies between 96° 30′ west and 100° west longitude. The greater portion of the country has an altitude of 800 to 1,400 feet. The surface of the country is rolling prairie, with numerous small rivers and creeks flowing east. The longer streams are wide, shallow, and very sandy. The shorter streams are narrow and have high, steep banks. In the eastern half there are considerable areas covered with timber, the greater part of which is black-jack and post-oak. Elm, cottonwood, pecan, hickory, red cedar, walnut, hackberry and honey-locust are common, but do not form separate forests as the oaks do. In the western part timber belts follow the streams, and in the extreme western part only brush and small trees are found. The soil is usually a fine sand, the particles lying very compactly.

Previous to the settlement of the country, in 1889, the prairies were burned off each year. This kept the soil poor in humus. There is very little clay soil in the territory except along the small streams, the bottomlands of which contain considerable clay. The soil is fertile and contains a good supply of plant-food. The subsoil is very compact, usually joint-clay, where the surface soil is a black or gray color; but the red or brown loam surface soil is usually underlaid with a more loose and mellow subsoil. The black and gray soils are usually found at greater altitudes, and are seldom covered with timber. Often these soils contain large quantities of alkali, and the well and spring water in such localities is very poor. Stone is abundant in some sections and very scarce in others, but there is not enough surface rock to be a factor in controlling the amount of tillable land. Red and gray sandstone are the most abundant.

The extremes of temperature between summer and winter are great. In some places the temperature reaches zero during the most severe storms of winter. Except during occasional storms, the winter is mild and usually dry. A snowfall of more than six inches in depth is arre, and soon melts. Plowing and other such farm work may be done nearly all winter. During the summer a maximum of 100° F. is frequently reached. The high temperature is nearly always accompanied by a dry wind. In the hottest weather the nights are cool and refreshing. The average mean temperature is about 60°. The wind is a prominent factor in the climate of Oklahoma. The prevailing wind is from the south during most of the year. The air is dry, and the wind and hot sun dry the soil rapidly. The rainfall usually is light during July and August, and the warm, dry winds from the south and southwest make this the most trying season for vegetation. The wind is so strong and constant that it does considerable damage to young trees and vines unless they are protected by some form of wind-break. Many snow and rain storms are accompanied by hard winds, which are seldom destructive.

The average annual rainfall for the territory is about 30 in. For the eastern half it is about 33 in., and gradually decreases to about 20 in. in the extreme western part. The rainfall for any one year varies greatly in different localities, and these areas of light and heavy precipitation are variable in size, shape and location from year to year. The line of average equal rainfall runs almost north and south, bearing to the west in the southern part of the territory. The winter and late summer are dry. Light snows fall during January, February and March, but usually melt in two or three days. Snow storms seldom reach the southern portion, and are light when they do. The rain and snow storms, almost without exception, travel from west and north to east and south. They travel very rapidly and last only a short time; the heaviest rains last only a few hours. Slow rains are rare, and come only during the colder part of the year. In 1897 there were about 250 days of sunshine, which is about the average. There is very little dark, foggy weather; and heavy dews, though common, are much lightened by the almost constant breeze.



1519. Geographical features of Oklahoma.

The flora of Oklahoma may be said to be a mixture of the floras of Kansas and Texas, there being few species found here that are not found in one or both of these states. The predominance of yellow flowers is one of its most prominent characteristics. The botanical collections of the country are far from complete, but are complete enough to justify the statement that the flora is not a very extensive one. The number of perennial species is very small, and only a small portion of these are trees. The trees are usually low and much branched, and give a poor quality of lumber, which is, no doubt, partly due to the annual burning, and neither represents the quality or quantity of timber which the country is capable of producing when protected from the fire. Wild fruit plants are abundant in nearly all parts of the territory, and usually bear moderately well. The plum, persimmon, grape, blackberry and dewberry are most common. With a reasonable amount of cultivation, most orchard fruits do well. Young orchards are beginning to bear in nearly all parts of the territory. These orchards contain only a short list of varieties, but most of these seem well adapted to the country. Most varieties show a strong tendency to early bearing. The fruit is of good form, size and quality, and promises to become one of the leading crops. See *Indian Territory*. O. M. MORRIS.

OKRA, or GUMBO (*Hibiscus esculentus*). Introduced into United States and West Indies from Africa, and cultivated for its fruit pods, which are used in soups, stews, catsups, etc. In soups and catsup, it gives body to the dish; stewed, it is mucilaginous, and while at first not agreeable to many people, a taste for it is easily acquired. It is also dried and canned for winter use. Sow in spring after the ground is thoroughly warmed, in good vegetable land. Make the rows 3 to 5 feet apart, according to variety, and drop seeds about 2 inches apart in the row; cover 1 or 2 inches deep. After plants are six inches high, thin to 1 foot apart for dwarf varieties and to about 3 feet for the largest varieties. The seedlings transplant with considerable difficulty, so they need to be started in flower-pots if an extra-early crop is desired. The pods must be gathered before the fiber develops in them: the size will vary with the variety, but if it is too "stringy" to cut with a dull case-knife it is too old. Keep all old pods cut off. The dwarf varieties are in greater favor in the South because of their habit of bearing early. A plant, constantly cropped, remains in bearing condition until frost kills it, but allowed to retain pods it suspends growth until the seeds have matured, when a second growth may take place. Okra will grow for years if not killed by frost or other adverse conditions. i. e., it makes an indeterminate growth like cotton, malva, hibiscus, etc. For shipping, cut the stems (peduncles) an inch or so long as to prevent wilting in transit. Pack firmly in vegetable crates. The demand for this vegetable is increasing, especially in New York City. Seed is easily grown and saved. The plant is subject to several diseases to such an extent that it is impracticable to raise a crop on certain pieces of land. Rotation is the best remedy.

P. H. ROLFS.

Okra is a half-hardy annual in the North, originally from Africa, introduced into the United States from the West Indies. It is cultivated for its young green pods, which are used in soups, stews and catsups, to impart a thick, viscous consistency, like tapioca or sago. When ripe, the black or brown white-eyed, globular seeds are sometimes roasted and used as a coffee substitute. Okra should be sown in a dry, warm soil, of medium fertility and texture, after danger of frost has passed. For an early crop the plants may be started in a hotbed four weeks earlier than sowings in the open ground. The seeds should be covered about an inch deep, 1–2 ft. asunder, and in rows 2–3½ ft. apart, according to the variety, whether dwarf or tall. In the South Okra is very generally cultivated; in the North it is almost unknown and only the dwarf varieties (Fig. 1520) succeed. M. G. KAINS.

1520.

Dwarf Density Okra.
A small variety valuable for the North.

OLD MAN. Another name for the Southernwood, *Artemisia Abrotanum;* also for the Rosemary, *Rosmarinus officinalis.*

OLD-MAN-AND-WOMAN, or common Houseleek. *Sempervivum tectorum.*

OLD MAN CACTUS. *Pilocereus senilis.*

OLD MAN'S BEARD. In Europe, *Clematis Vitalba;* in America our common Wild Clematis, *C. Virginiana;* also *Saxifraga sarmentosa;* rarely the Fringe Tree, Chionanthus.

ÒLEA (classical name for Olive). *Oleàceæ.* OLIVE. Between 30 and 40 trees or shrubs of the tropical and warm-temperate parts of the Old World to New Zealand. Lvs. evergreen and thick, opposite, usually entire, and often rusty-tomentose beneath: fls. small, usually imperfect, white or whitish, in forking panicles or fascicles, the short calyx 4-toothed (corolla sometimes none), the short-tubed corolla with 4 valvate lobes, the stamens 2: ovary 2-loculed, bearing a short style and capitate stigma: fr. an oblong or ovoid drupe. The best known species is **O. Europæa**, Linn. (see *Olive*). It is a small tree, rarely exceeding 20 or 25 ft. in height, and bearing small lanceolate lvs. and axillary forking racemes of yellowish white fragrant fls. It is probably native to the Mediterranean region. It has been in cultivation from the earliest times. **O. chrysophýlla**, Lam., from tropical Africa, has been introduced by F. Franceschi, Santa Barbara. It is a small tree, noteworthy because of the golden color of the under surface of the lvs. The drupe is large and blackish: lvs. lanceolate, acute, entire, shining above. For *O. fragrans, illicifolia, Aquifolium*, and for garden treatment of the true Oleas, see *Osmanthus.* L. H. B.

OLEANDER. See *Nerium Oleander.*

OLEÀRIA (derivation uncertain). *Compósitæ. O. Haastii* in New Zealand forms a small bushy tree of rounded form, with very stout branches densely clothed with deep green foliage and covered with numerous small white flowers. The genus is a very large one, and is confined to Australia and New Zealand, where many of the species are known as Daisy trees. *O. Haastii*, however, is far removed from our common idea of either a daisy or a composite. The heads are about three-eighths of an inch across, and look like an ordinary small 4-petaled white flower. They are borne in flattish branched clusters of a dozen or so. The rays vary from 3 to 5 in number, and the disk is reduced to 4–6 yellow fls. This rare plant is said to be hardy in eastern England. It was offered in America in 1899.

Olearia is a genus of 85 or more species. Shrubs, sometimes arborescent or suffrutescent, rarely branching herbs: lvs. alternate, rarely opposite, feather-veined or 1-nerved, entire or dentate: heads large, medium or small, solitary, corymbose or panicled: rays white or blue: disk yellow or rarely purplish blue. For generic characters, see Flora Australiensis 3:463, where the genus is split into 5 sections based on the kind of hairs forming the silvery coating usually found on the under sides of the lvs.

Haástii, Hook. Lvs. ¾–1 in. long, elliptic or ovate-oblong, obtuse, short-petioled, very leathery, dark green above, white, but not shiny below. B.M. 6592. G.C. III. 20:533. Gn. 38, p. 149. F. 1874, p. 198. W. M.

OLEASTER. Popular name of *Elæagnus hortensis.*

OLIVE. Figs. 1521, 1522. California is the principal state in the Union in which the Olive is grown, although there are portions of Arizona and New Mexico in which the climatic conditions are such that it is probable that the industry will in time become permanently established on a rather large scale.

The history of the Olive is of peculiar interest, not alone because it is so closely interwoven with the economics of the ancients, as well as with the daily life of the people in Asia Minor and in southern Europe, but because of the vicissitudes of cultivation, the difficulties to confront—not yet overcome—and the great possibilities for the culture of the fruit commercially. Botanically, the Olive is known as *Olea Europæa* (which see), belonging to the natural family Oleaceæ. Olea is a genus of trees and shrubs "having opposite, evergreen, leathery lvs., which are generally entire, smooth, and minutely scaly; small fls. in compound axillary racemes, or in thyrsi at the end of the twigs; a small 4-toothed calyx, a 4-cleft corolla, 2 stamens, a 2-cleft stigma: the fr. a drupe." It is a native of Syria and other Asiatic countries, and has for many centuries become naturalized in the south of Europe.

In the Mission San Diego, in the far southern part of California, were planted the first Olives, according to the early historical accounts, which are more or less authentic. It is known that in 1769 sundry fruit and vegetable seeds were imported into California from Mexico by José de Galvez, and it is assumed that among them were seeds of the Olive, for in after years, as new missions were built, the Fathers planted Olive trees grown from cuttings taken from trees at the old San Diego Mission. Hence the name "Mission" by which this variety became known; and it was the only variety with which Californians were familiar until about 1880, after which time many trees were annually imported from Italy, Spain and France, though some were imported in smaller numbers previous to this time.

1521. Olive in flower and fruit.

There is an immense area in California suited to the cultivation of the Olive, both as to climate and soil. It extends from the southernmost extremity to the foot of Mount Shasta, nearly 600 miles, and in width from the foot-hills of the Sierra Nevadas to the coast, varied according to soil and other local conditions. Theoretically this range is true, the Olive requiring a mean annual temperature of 57°, the mean for the coldest month to be 41°, and at no time must the temperature fall below 14°. But while the Olive will grow and bear fruit under these conditions, as with all other fruits there are certain peculiar localities where soil and climate combined are best adapted to its production in the greatest degree of excellence and in the most remunerative form. As with other fruits, there was formerly much misconception regarding the requirements of the Olive, which has resulted in a great deal of disappointment and pecuniary loss. Pessimists proclaimed that the culture of the Olive was a failure, that it "did not pay," but they forgot that lack of success might be due to errors in judgment on the part of the planter.

The Olive thrives best in a warm, dry atmosphere, where the soil is rich and well drained. However, it will grow and bear crops in a greater variety of soils than most trees. While the tree may live when the temperature falls to 14°, the chances are against it, and any frost during blossoming, or great heat or strong winds at this time or while the fruit is young, is likely to destroy prospects of a crop, or to materially diminish them. Because the Olive was said to be able to grow anywhere in California, and to prefer a rocky hillside, hundreds of thousands of trees have been planted in such uncongenial surroundings, which of itself is sufficient reason why the present crop returns do not at all come up to expectations according to the published estimate of acreage in trees compiled from the books of the county assessors. Such estimate shows the number of Olive trees in California to be nearly 3,000,000, but a large number of these trees are neglected, being unprofitable because planted where neither plant-food nor water is available in sufficient quantity. Many other groves were planted too near the coast, where the ocean fogs are prevalent during the summer months. This condition was not right, for while the trees would grow and bear crops, the fruit was not of the same quality as that produced under a sunny sky, and the trees suffered more from attacks of scale (Lecanium) in a foggy climate than in the warmer interior valleys.

The Olive grows to perfection in good soils throughout the length and breadth of the San Joaquin and Sacramento valleys; in many of the smaller Coast Range valleys, and up to an elevation of 1,000 feet or more in this range, and in the warm belt of the foot-hills of the Sierra Nevada mountains. As fine trees for their age and as fine fruit, either for oil or for pickling, may be seen as far north as Oroville and Palermo, in Butte county, and all through the northern Sacramento valley, as in the counties in the extreme south.

The Olive is propagated in various ways: from the seed, from tips, from long cuttings, from sprouts, suckers, and by layering. The seeds require some time to germinate, frequently two seasons, and the growth of the young plants is slow at first. This method, including the after-budding or grafting, is tedious, and therefore not popular, although a tree on a seedling root will be more robust and long-lived. Nurserymen usually adopt the "tip" system. "Tips" are small branches or ends, usually the laterals, taken from the tree when it is in its most dormant state, cut 4 or 5 inches long, the upper lvs. partially trimmed, while the lower ones are cut off close to the stem. These are then planted in a sand-bed or the propagating box until sufficiently well rooted to transplant to the nursery row. Many growers prefer to grow their trees from cuttings 14 inches long, made from 2- or 3-year-old wood, and up to 1½ inches in diameter.

The Olive requires irrigating to the same extent as other trees. In other words, if there is not sufficient moisture by rainfall, then water must be applied artificially. As it thrives best in the warmer regions of the state, where evaporation is very rapid, the inference must be that irrigation is generally necessary for the Olive. There is a saying in Italy, "No manure, no oil," which means that the Olive needs suitable food, and without water it cannot obtain it.

Almost every known variety has been imported into California, and, unfortunately, planted too extensively before it had been determined by experiment which was the better adapted to the varied, and to some extent foreign, conditions. Hence many orchards are unprofitable because the varieties planted, from whatever cause, do not bear crops in paying quantity. The "Mission" is still more largely planted than any other variety, as it seems more universally adaptive, and is valuable both for oil and for pickling. Some of the other varieties which are known to be good, and which may supersede the Mission, are, for oil, Atrorubens, Manzanillo, Nevadillo Blanco, Pendoulier, Precox, Razzo, Rubra; for pickling, Ascolano, Lucques, Macrocarpa, Polymorpha, Regalis, Sevillano. Atroviolacea is valuable for drying, losing its bitter taste in the process; also the Sweet Olive, which has no bitterness.

For extracting the oil the same methods are employed which were in vogue thousands of years ago, with this difference, that the improved machinery of the present day with steam power reduces the question of labor to a minimum. It is essential that the Olives be perfectly ripe and sound; when picked they are spread upon trays piled one above the other, allowing for free circulation of air, until the water in them is mostly evaporated. Crushing is done under stone or iron rollers that are made to revolve in a large stone or iron basin in which about 350 pounds of Olives are placed. From this pulp the first or "virgin" oil is extracted by gentle pressure, the pomace is removed and again pressed to secure a second grade of oil, and sometimes a third grade is secured. The oil left still in the pomace is used by the soap-maker in the manufacture of Castile soap, and the residuum is valuable as a fertilizer. There are many details, all being important in themselves, absolute cleanliness and scrupulous care being observed in all the operations.

Pickling Olives is a simple matter in theory, but even more judgment is needed than in the oil-extracting process. The "bitter" is withdrawn by the use of lye, or else by long and daily immersions in fresh water. There is an increasing demand for Californian ripe pickled Olives, the crop invariably being sold before ready for delivery. In quality and flavor they are distinctly superior to the best imported green Olives. The most discouraging feature connected with the marketing of Olive oil is the fact that the imported oils are nearly all adulterated more or less either at foreign ports or in the United States, some showing 80 or 90 per cent of cottonseed. Until some national law is passed by which cottonseed oil shall be labeled and sold as such and not under names designed merely to deceive, such as "Pure Lucca Oil," "Pure California Oil," "Sweet Olive Oil," etc., the prospects for the California Olive-grower will not brighten as far as the production of oil is concerned. Given such a law, California can and will produce all the Olive oil that is needed in the United States.

See report on the Condition of Olive Culture in California by A. P. Hayne, Bull. 129 of Calif. Exp. Sta., issued May, 1900. LEONARD COATES.

OLIVE PRODUCTS.—Olives are almost entirely used for making oil and pickles; some varieties are prepared by simple drying, but the quantity so used in the U. S. is very small and need hardly be considered a market product as yet. The general use of Olive oil in this country has been somewhat retarded by the introduction and sale of refined (clarified) cottonseed oil under various names and brands as substitutes for the more expensive genuine oil. In some cases Olive oil is adulterated, to a greater or less degree, with the cheaper cottonseed oil, and sold as "pure Olive oil." This state of affairs is owing almost entirely to the fact that the general American public does not, as yet, appreciate the delicate flavor of a properly prepared pure Olive oil. At present the market demands that an oil must be clear and brilliant, without reference to its quality or flavor, and consequently even pure Olive oil is "clarified" and filtered until it loses its delicate and characteristic aroma. It is then no better than the cheaper cottonseed product with which it has to compete. But gradually the differences are being appreciated, and the demand for the true article is slowly but surely increasing.

Pickled ripe Olives have steadily grown in favor, and the more their value as a food material is appreciated the greater will be the demand for a properly prepared product. As yet little or no pickled green Olives are prepared in California. These do not serve as food, however, as do the ripe Olives, but merely as a relish, and must be considered as a delicacy rather than as a staple article of diet; hence their preparation can only be undertaken under special conditions, each manufacturer having his own particular process or recipe.

The manufacture of Olive oil, though apparently a simple process, requires the most painstaking care, and the closest attention to every detail, for the production of high-grade oil. To begin, the fruit must be carefully picked by hand, avoiding all unsound drupes, and handled as little as possible in order to avoid bruising. In some of the orchards in Europe the fruits are dropped into pails half filled with water, thus reducing to a minimum the danger of bruising. This is specially important when the Olives have to be kept for any length of time before crushing. It is by far the best plan to crush immediately, but this is not always possible. Then the Olives must be dried, and stored in layers not over three inches in depth, with a free circulation of air between the layers, in order to prevent molding or fermenting. In no case must unsound fruit be used, as even a few slightly moldy or fermented berries will impart a disagreeable odor and flavor to the entire product. When Olives have been frosted they must be picked and crushed immediately; a delay of twenty-four hours will render them unfit for use. The proper stage of ripeness is an important factor. The tendency is to allow the Olives to overripen. This is a mistake, as the quality of the oil is thereby deteriorated. Just after changing color has been found to be the proper stage for picking, for then the maximum oil-content and keeping qualities of the oil have been reached.

1522. California Olives, showing one method of pruning.

Various devices have been used for crushing. Formerly it was the practice to crush fruit and pits together between heavy millstones; but it has been found that the oil from the kernels not only imparts its characteristic flavor to the flesh oil, but also impairs its keeping qualities. At present crushers are used with the stones set far enough apart to avoid breaking the pits. Roller crushers are sometimes used, but these are, as a rule, objectionable on account of the liability of chemical action between the acids of the Olive juice and the iron, resulting in an inky color and taste. In Europe the crushed pulp is pressed in special mats made of esparto grass, holding about twenty-five pounds each; but in California these mats have been found to be too expensive, and linen or sail-cloth has been successfully used instead. The best form of press is a screw-press, so arranged that the pressure is very gradual, and provided with a perforated steel basket (wood would not do on account of the absorbed oil becoming rancid), and all exposed cast-iron carefully covered with tin. The steel basket is filled with pulp in layers of about twenty-five pounds each, each layer being surrounded by cloth, and as much direct screw pressure as possible applied very gradually. After all the juice has run out, the resulting cakes of pulp are taken out, mixed with pure, cool water, and again pressed, this time as much as possible with the screw lever. This operation may be repeated a third and even a fourth time, the resulting oil being each time of inferior quality. In California, as a rule, but two pressings are made, forming first- and second-grade oil; in some cases the oils from the two pressings are mixed, and but one grade marketed. The oil can be recovered from the juice by simply allowing it to rise and accumulate on the surface, as it will naturally, being lighter than the watery juice. But this process is both slow and dangerous, because fermentation is liable to start in the juice, and greatly impair the quality of the oil. It thus becomes important to separate the oil as quickly as possible from the acrid juice. Several means have been devised for accomplishing this. The most satisfactory (of Italian invention), and one which has been tried at the California Experiment Station, is the washing out of the impurities by means of pure water. The apparatus consists of a tin tank about 4 feet high and 2 feet in diameter, provided with a perforated false bottom, below which a running stream of pure, cool water is admitted. Just above this false bottom a small stream of juice is run in. The water thus washes through the juice, the oil rising at once to the surface, passes through the long 4-foot column of water, and is thus freed from most of the vegetable matter, which falls to the bottom, where it is drawn off through an outlet provided for that purpose. The oil as it comes from this "separator," or the hand-skimmings from the surface of the juice, has still fine particles of pulp mixed with it, which impart a "prickly" taste, and it must be allowed to stand in a cool (about 50° F.) room until these impurities settle. It is then "racked" off, and can be sold as "new oil;" or again allowed to stand for further precipitation and racking until no more dregs are visible. This will give a clear oil of the true Olive flavor and color. But the American market demands a perfectly clear and brilliant oil put up in glass, and this is usually obtained by filtering. This is detrimental to the flavor of the oil, for the more it is filtered the more neutral and "greasy" will the taste become. This practice, therefore, should be discouraged, and the desire for the true Olive flavor cultivated, making it impossible for cheap, neutral, greasy substitutes (such as cottonseed oil) to take its place in the taste of the consumer. Of the highest importance throughout the entire process is the item of cleanliness. The mill, press, floors, trays and all apparatus should be scalded daily—when in use—and no strong odor permitted about the premises; for so absorptive is pure Olive oil that it will immediately "take up" all unpleasant odors, and thus impair its delicate flavor.

For making pickles, no set rules can be laid down except to emphasize the importance of careful picking and handling (to avoid bruising) and cleanliness. Here, again, the Olives should not be allowed to overripen; if they are, they are likely to soften, and a first class pickle will be impossible. The Olives as they come from the trees contain a most acrid and bitter principle. This is extracted by means of pure water, changed daily, or by a weak solution of lye. The latter is almost universally used, though the water-extracted pickles are considered the best. The extreme length of time required (from 30 to 90 days), and the consequent danger from bacterial and fungoid contamination in the water process, renders its use impossible, except in special cases. For lye-extraction a solution containing from 1 to 2 per cent of lye is used, and the Olives allowed to stand in this until nearly all the bitter principle is extracted. Then they are soaked in pure fresh water (changed two or three times daily) until all the lye has been dissolved out. They are now ready for salting. This is done gradually, i. e., a start is made with a weak brine, and the strength gradually increased from time to time until it is strong enough to float an egg. This prevents shrinking and consequent toughening. The pickles are now ready for storing, and if properly prepared and put into boiled brine will keep for years. This is the process in outline; but in actual practice each detail will require modification brought about by varying conditions, and no "rule-of-thumb" can be laid down to suit all cases.

See Bulletins 104 and 123, and the annual reports of the California Experiment Station.

ARNOLD V. STUBENRAUCH.

OLIVE-BARK TREE. *Terminalia Catappa.*

OLIVE, WILD. *Olea Europæa;* also *Elæagnus.*

OMPHALÒDES (Greek, *navel-shaped;* referring to the seeds) *Borraginàceæ.* NAVELWORT. Of this genus we cultivate 3 low-growing, hardy herbs, with fls. much like those of forget-me-not, but larger and usually with a white 5-pointed star dividing the corolla-lobes. The fls. are often more or less pinkish, particularly toward the center. They like moist situations, but in deep shade grow too luxuriantly; also the fls. are fewer and of a weaker blue. Partial shade or full sunlight is preferable. The commonest kind is the "Creeping Forget-me-not," *O. verna*, which is a spring-blooming perennial of easy culture, producing runners freely and easily prop. by division. It can be grown by the yard in a rockery and can be easily naturalized in wild, moist, half-shaded spots. It is also fine for fringing walks. It is said to like best a cool, moist loam, with a few bits of sandstone among which the roots may ramble and from which they may derive coolness and moisture. The choicest kind is *O. Luciliæ*, also a spring-blooming perennial, but of tufted habit and impatient of division. It is a typical "uncertain" alpine: for some it flourishes like a weed; others have tried time and again to establish it permanently without success. It is a native of two localities in Asia Minor at a height of 8,000 ft., and grows in fissures of vertical cliffs. It is said to like a loose limestone soil, deep and well drained. When once established it self-sows. In America *O. Luciliæ* has been successfully grown by J. B. Keller, but the plant is not now advertised in this country. *O. linifolia* is a summer-blooming annual of easy culture. *O. verna* has a white-fld. form, which is pretty but lacks the interest of a blue-fld. forget-me-not.

Omphalodes is a genus of about 10 species, native to the Mediterranean region, middle Asia and Japan. Annual or perennial herbs of low growth, glabrous or sparsely and minutely villous: root-lvs. long-stalked, lanceolate, ovate or cordate; stem-lvs. few, alternate: racemes lax, with or without a leafy bract at the base: calyx 5-parted; corolla-tube very short; lobes 5, imbricated, broad, obtuse; stamens 5, affixed to the tube, included: ovary 4-lobed. From Myosotis it differs in having depressed nutlets and nearly horizontal seeds, while in the forget-me-not genus the nutlets are ovoid, and the seeds erect. The descriptions given below are adapted from DeCandolle's Prodromus, vol. 10 (1846). with which the pictures cited agree rather poorly.

A. *Plant a summer-blooming annual.*

linifòlia, Mœnch. Erect, slightly glaucous, 1 ft. high: radical lvs. wedge-shaped; stem-lvs. linear-lanceolate, margin remotely ciliate: corolla twice as long as the calyx: nutlets dentate, inflexed at the margin. Dry, stony hills of Spain and Portugal. June–Sept. According to DeCandolle, the fls. are normally white, and it is var. **cæruléscens** which has bluish fls., sometimes tinged with rose. This belongs to a group in which the nutlets are affixed laterally and lengthwise to the style, which is pyramidal and has a square base.

AA. *Plants spring-blooming perennials.*

B. *Habit creeping by runners.*

vérna, Mœnch. CREEPING FORGET-ME-NOT. Stoloniferous: flowering-stem erect: lvs. sparsely puberulous; radical ones long-petioled, ovate or subcordate; stem-lvs. short-petioled, sublanceolate; all lvs. acuminate, callous at the apex: fls. borne in pairs in a raceme. April, May. Eu. B.M. 7 (*Cynoglossum Omphalodes*). Gn. 26, p. 315; 40:818.—Flowers light blue, according to DeCandolle. Var. **álba** is also offered.

BB. *Habit tufted, not creeping.*

Lucíliæ, Boiss. Glabrous, tufted: lvs. oblong, obtuse, the radical lvs. narrowed into a long petiole, the stem-lvs. sessile, upper ones ovate: pedicels longer than the nearest floral leaf, erect, then arcuate-recurved: fls. blue; calyx-lobes ovate-oblong, somewhat obtuse, about one-fourth as long as the pedicels; corolla broadly funnel-shaped, about four times as long as the calyx: nutlets with an entire membranaceous margin. Mt. Sypilus near Manesis, and in Cilicia near Gulf of Scanderoon, at 8,000 ft. B.M. 6047 (some fls. light blue, others pinkish purple, all with a white eye). Gn. 27:482; p. 194.—This and *O. verna* belong to a group in which the nutlets are depressed, shorter than the persistent style, scarcely adhering to it at the base, and smaller than the calyx, to which it is adnate. Fls. about ½ in. across, twice as large as those of *O. verna.*

W. M.

ONCÍDIUM (Greek, *a tubercle;* alluding to the crest on the labellum). *Orchidàceæ.* A large genus of orchids with over 300 species distributed in Mexico, Central and tropical America, and in the West Indies. In range of altitude the genus extends from the hot coast regions to elevations of 12,000 ft. in the Andes. The fls. of this genus show a remarkable diversity of form. In *O. varicosum*, *O. tigrinum* and related species, the labellum is greatly developed, forming the most conspicuous part of the flower, while in *O. serratum* and *O. macranthum* it is inconspicuous. The sepals and petals vary in size in relation to each other and to the rest of the flower. A remarkable instance is *O. Papilio*, in which the petals and dorsal sepal have been transformed into linear-erect segments, recalling, on a large scale, the antennæ of some insect. The general habit of the plants is no less variable than the fls. They range in size from small, erect forms scarcely 6 inches in height (*O. pumilum*) to those resembling *O. altissimum*, with immense climbing panicles 9 to 12 ft. high, and covered with numerous medium-sized fls. The prevailing color of the fls. is yellow, spotted and barred with brown. White or rose-colored fls. occur in a few rare instances (*O. incurvum*, *O. ornithorhynchum*).

Pseudobulbs usually present, wanting in a few species, 1-2-lvd., with sheathing lvs. at the base: lvs. plane, terete or triangular: petals like the dorsal sepal but often much larger; lateral sepals either free or partially united; labellum variable, but never with its base parallel to the column (Odontoglossum), spreading nearly at right angles to the column: column short, winged.

As a class, Oncidiums are short-lived under cultivation. Few growers succeed in maintaining them in good condition for any great length of time. The stock is constantly renewed from the tropics.

Heinrich Hasselbring.

The genus Oncidium embraces a great number of species which are found growing under such peculiar and varied conditions in their native homes that imitation of the same is usually impracticable and often quite impossible. A fair degree of success, however, may be obtained by careful observation and distribution of the exceptionally difficult species among the several orchid departments.

1523. Oncidium serratum (× ½).

The Sarcoptera section, which embraces such species as *O. Cavendishianum*, *O. Lanceanum*, *O. luridum*, *O. pulvinatum* and others of similar structure, and the *O. Papilio* section, with *O. ampliatum*, may be successfully grown in a bright, warm portion of the Cattleya department in small baskets suspended from the roof, using for a compost a mixture of clean chopped peat and sphagnum moss, freely interspersed with lumps of broken charcoal.

O. cucullatum, *O. incurvum*, *O. macranthum*, *O. ornithorhynchum*, *O. Phalænopsis*, *O. varicosum*, with a few others of like nature, do well under treatment similar to that given for Odontoglossums, which see.

When a large collection of species is cultivated, a majority, including many of the above, can be readily grown in one house if it be especially adapted to them. Such a house should be a span-roof structure of east and west exposure, at an angle of about 40°, which will admit the longest possible light. The early morning and late afternoon sun striking the glass at right angles produces and prolongs the natural sun heat for a greater portion of the day, while at midday, when the outside temperature is highest, the sun's rays strike the glass obliquely, giving less heat, with little danger of the plants becoming sunburned from lenses in the glass. Oncidiums require more sun and air than most orchids.

The benches may be of either wood or stone, and should be covered an inch or two in depth with sand, ashes or gravel. The benches and paths should be wet down once or twice daily to insure a moist atmosphere. Ventilators should be arranged on both sides of the roof: air may then be freely admitted without causing direct drafts on the plants by using the ventilators on the sheltered side. In winter the temperature should range from 50° to 55° F. at night and 60° to 65° by day, or a few degrees more with sun heat and ventilation. In summer it must be kept as low as outside conditions will permit. From March until October shading must be applied to the glass sufficiently heavy to keep down the temperature without excluding indirect solar influence. A good shading is made of turpentine and white lead; it stands well and is easily removed. It can be applied rapidly with a whitewash brush on a long pole, and removed with a hard brush in the fall.

Oncidiums may be grown in either pots or baskets, but as many species are of rambling habit, the latter are preferable. The tiny species, such as *O. Limminghii*, do best on blocks with little compost beneath them. Clean chopped peat fiber and live sphagnum moss, equal parts, make the best general growing material, and this should be liberally interspersed with broken pieces of charcoal. The plants in all cases must be securely fastened, and the compost must be pressed in moderately firm, but should be used sparingly. Overhead syringing should be given frequently, once or twice a day in bright weather, but care must be taken not to keep the compost too wet, or the roots are liable to decay: it is advisable to let them dry out occasionally.

Stock is increased by division or notching the rhizome between the pseudobulbs just before the growing season, allowing three or four pseudobulbs to each piece and separating the parts after the first growth is matured.

For other cultural notes on the genus, see Veitch's Man. of Orch. Plants, vol. 2, Section Oncidium, page 5; Orchid Review 1:296, and Nicholson's Dict. of Gard. 2:483.

Robert M. Grey.

Owing to the wide geographical distribution of the Oncidiums, it is almost impossible to give any general cultural directions for the whole group. We find that the greater bulk of the Oncidiums succeeds admirably in a Cattleya house, and by placing such varieties as enjoy more heat and moisture in the warmest part of the house, the balance of the Oncidiums are comparatively easy to take care of in any part of the structure wherever light, air and moisture are maintained. The following are a few enjoying more heat than the others: *Oncidium ampliatum*, *O. bicallosum*, *O. Carthaginense*, *O. Cavendishianum*, *O. Lanceanum* and *O. luridum*.

Oncidium varicosum, the most popular and most useful of all the Oncidiums, delights in a position close to the glass, especially under the ridge of the house, where it receives an abundance of light and air, and in such a position this plant will grow well and flower profusely. *Oncidium Papilio* and *O. Kramerianum* do best grown in baskets or on blocks and kept rather dry.

The following thrive well in a cool house, such as an Odontoglossum house: *Oncidium macranthum*, *O. ornithorhynchum*, *O. incurvum*, *O. tigrinum* and *O. cucullatum*. The first mentioned is one of the most beautiful of the entire genus, but being a plant very difficult to import, very few are seen in collections in this country. It occurs at a very high elevation in the Cordilleras of Ecuador.

Oncidium cucullatum is another plant which is difficult to grow successfully here on account of our hot summers. It occurs in several places in the Colombian Cordilleras, but always at a very high elevation. With these few exceptions mentioned, the greater part of the Oncidiums will succeed in a Cattleya house. Indeed, most of the species are found in the Cattleya and Lælia regions under more or less similar conditions. A temperature of 55° to 60° at night, and correspondingly higher during the day, will suit most species. An abundant supply of air and light, though in partial shade, is indispensable. Water must be used freely during the growing season and somewhat reduced during their respective resting seasons. An occasional dipping in manure water (either cow or sheep manure) will greatly assist these plants in bringing to perfection their flower-spikes, which are oftentimes very large. In a good many species the flower-spikes are out of all proportion to the size of the plants, and unless they are assisted as indicated, they will very soon run out.

For potting, use very soft fibrous peat, with a sprinkling of live sphagnum. Pot firmly, or the plants will be very slow in taking hold. JOHN E. LAGER.

INDEX.

albiflorum, 31.
album, 31.
altissimum, 24, 25.
ampliatum, 19.
aurosum, 20.
Barkeri, 21.
Batemannianum, 28.
Baueri, 24.
bicallosum, 40.
bicolor, 12.
Carthaginense, 43.
Cavendishianum, 41.
Cebolleta, 48.
cheirophorum, 37.
concolor, 18.
cornigerum, 10.
crispum, 9.
Crista-galli, 39.
cucullatum, 11.
curtum, 8.
dasystyle, 17.
divaricatum, 32.
Eckhardtii, 45.
excavatum, 20.
flexuosum, 13.
Forbesii, 7.
grandiflorum, 9, 21.
guttatum, 44.
Harrisianum, 29.
Harrisonianum, 29.
hastiferum, 5.
Henchmannii, 43.
incurvum, 23.
iridifolium, 39.
Janeirense, 16.
Jonesianum, 47.
juncifolium, 48.
Kramerianum, 46.
Lanceanum, 42.
leucochilum, 30.
Limminghii, 36.
longipes, 16.
Louvrexianum, 42.
luridum, 44.
macranthum, 5.
maculatum, 35.
Marshallianum, 6.
Martianum, 12.
micropogon, 1.
nubigenum, 11.
ornithorhynchum, 31.
Papilio, 45.
Phalænopsis, 15.
phymatochilum, 2.
pulvinatum, 33.
pumilum, 38.
reflexum, 27.
Rogersii, 14.
roseum, 43.
sanguineum, 43.
serratum, 3.
sphacelatum, 26.
splendidum, 22.
superbiens, 4.
superbum, 1, 42.
tigrinum, 21.
triquetrum, 49.
undulatum, 43.
unguiculatum, 18, 21.
varicosum, 14.
Warneri, 34.

SYNOPSIS OF SECTIONS.

A. *Leaves plane, not terete.*
B. *Labellum smaller than the sepals and petals*..........Species 1–5
BB. *Labellum at least as large as the other segments, often greatly exceeding them.*
C. *Lateral sepals more or less united at base.*..........Species 6–18
CC. *Lateral sepals free.*
D. *All the segments having a distinct blade, none of them linear-subterete.*
E. *Pseudobulbs present*..........Species 19–37
EE. *Pseudobulbs wanting or obsolete*...Species 38–44
DD. *Only lateral sepals with distinct blade; dorsal sepal and petals elongate, linear, erect, with an obsolete blade*....Species 45–46
AA. *Lvs. terete or subterete*..........Species 47–48
AAA. *Lvs. subtriangular in section*......Species 49

DESCRIPTION OF SPECIES.

A. *Lateral sepals united at base*..1. **micropogon**
AA. *Lateral sepals free.*
B. *Sepals and petals linear, flaccid*..........2. **phymatochilum**
BB. *Sepals and petals broad, serrate*..........3. **serratum**
BBB. *Sepals and petals broad, entire or subentire.*
C. *Fls. brown*..........4. **superbiens**
CC. *Fls. yellow*..........5. **macranthum**

1. **micropògon**, Reichb. f. Pseudobulbs almost in 2 rows on the rhizome, broadly ovoid: lvs. 4–6 in. long, linear-oblong, rounded at the top, leathery: raceme 8–10 in. long, on a long stalk, flexuous, pendulous: fls. 1½ in. across; sepals linear-oblong, undulate, yellow, barred with brown; petals clawed, orbicular, yellow, with a deep red-brown claw; labellum yellow, smaller than the petals, having 3 almost equal, rounded, clawed lobes. Aug. Trop. Amer. B.M. 6971.—Var. **supérbum**, Hort., is advertised.

2. **phymatochilum**, Lindl. Pseudobulbs broadly fusiform, 4–5 in. long, purplish brown, with several large scales at the base: lvs. membranous, oblanceolate, 12–14 in. long: scape rather slender, over 1 ft. long, with a pendent panicle more than a foot long: sepals and petals linear-subulate, flaccid and somewhat twisted, greenish yellow, with deep orange blotches; labellum shorter than the sepals, white, with a yellow and orange crest; the middle lobe triangular-ovate, acuminate. Brazil. B.M. 5214. F.S. 23:2465. G.C. 1848:139.

3. **serràtum**, Lindl. Fig. 1523. Pseudobulbs 4–6 in. long, partly enclosed by sheathing lvs., 1–2-lvd.: lvs. about 1 ft. long and 2 in. broad: inflorescence a long, twining, loosely-branched panicle, 6–10 ft. long: fls. numerous, 3 in. across; upper sepals broad, reniform, the lateral ones very much longer, obovate, all chocolate-brown, with yellow tips and margins, strongly undulate, serrate; petals shorter, oblong, wavy and curled so that they almost meet over the column, yellow with brown spots, margins serrate; labellum small, hastate, fleshy, with a crest of 5 ridges. Winter. Peru. B.M. 5632. F.S. 6, p. 167.

4. **supérbiens**, Reichb. f. Pseudobulbs 3–4 in. long, ovate to ovate-lanceolate, much flattened: lvs. linear, 14 in. long and 1¼–1½ in. broad, some sheathing the pseudobulb: panicle 2–3 ft. long, loosely branched and flexuous, bearing 20–30 fls. each 2½ in. in diam.: sepals long-clawed, undulate, chocolate-brown with yellow tips; the upper one trowel-shaped, with a cordate base, the lower pair more ovate; petals rather smaller, with shorter, broader claws, much recurved and wavy, yellow with brown bars; labellum less than half as large as the sepals, revolute, trowel-shaped, with auriculate side lobes, brown with a yellow crest. Spring. Venezuela, Colombia. B.M. 5980.

5. **macránthum**, Lindl. (*O. hastiferum*, Hort.). Pseudobulbs ovoid or flask-shaped, 3 in. long: lvs. narrowly lanceolate, acuminate, 1 ft. long: panicle climbing, loosely branched and many-fld.: fls. 3–4 in. across; sepals rounded-oblong, with green claws, the upper one yellowish brown, the lower pair orange-yellow; petals similar, golden yellow, streaked with blood-red at the base; labellum small, hastate, purple-brown, with a prominent white crest. Spring and summer. Cent. Amer. B.M. 5743. Gn. 24:416. F. 1871, p. 187. J.H. III. 34:337.—A magnificent orchid, of which there are several varieties, some of secondary merit.

A. *Petals clawed, with a broad, obovate or rounded blade, not much smaller than the labellum.*
B. *Fls. yellow: column wings short, quadrate*..........6. **Marshallianum**
BB. *Fls. red-brown: column wings narrow, angular*..........7. **Forbesii**
BBB. *Fls. dull brown, with yellow markings.*
C. *Column wings small, truncate.* 8. **curtum**
CC. *Column wings large, sharply serrate*..........9. **crispum**
AA. *Petals and dorsal sepals obovate, cucullate, not clawed*..10. **cornigerum**
AAA. *Petals and dorsal sepals subsimilar, very small: labellum larger than the rest of the flower.*
BB. *Labellum white, spotted with rose-purple*..........11. **cucullatum**
BB. *Labellum yellow.*
C. *Blade bifid*..........12. **Martianum**
13. **flexuosum**
CC. *Blade quadrifid*..........14. **varicosum**
AAAA. *Petals and sepals lanceolate, ovate, etc., at least one-half as long as the labellum and of a different form.*
B. *Fls. white, spotted with purple*.15. **Phalænopsis**
BB. *Fls. yellow or greenish, spotted and barred with brown.*
C. *Crest serrate*..........16. **longipes**
CC. *Crest a smooth, heart-shaped callus*..........17. **dasystyle**
BBB. *Fls. entirely yellow*..........18. **concolor**

6. **Marshalliànum**, Reichb. f. Pseudobulbs ovoid, 2–4 in. long: lvs. narrowly oblong, 6–8 in. long: fls. numerous, 2⅓ in. across, borne on a stout panicle 1–2 ft. high; the upper sepals oblong-apiculate, the lateral ones united, yellow, with purplish bands; petals much larger, fiddle-shaped, wavy and 2-lobed, golden yellow, with few blotches of chocolate-brown; labellum with a very large spreading 2-lobed middle lobe and ear-like side lobes, yellow, with orange-red spots on the base. May. Brazil. B.M. 5725. F.M. 1877:285.—A very effective and showy plant related to *O. crispum*.

7. **Fórbesii**, Hook. Pseudobulbs rather small, oblong, compressed and sulcate: lvs. lanceolate, dark green, 9 in. long: panicle about 1 ft. high, bearing numerous handsome fls. 2 in. across: fls. rich reddish brown, margined with yellow; sepals small, obovate; petals twice as large, obovate-rotund; side lobes of the labellum small; middle lobe spreading, fan-shaped. Autumn. Brazil. B.M. 3705. G.C. II. 11:525.—A rare but very ornamental orchid.

8. **cúrtum**, Lindl. Lvs. and pseudobulbs like those of *O. crispum:* inflorescence an erect, much-branched pyramidal panicle: fls. 1–1½ in. across: lateral sepals united, rather small; dorsal sepals and petals obovate-obtuse, yellow, with reddish brown bars and blotches; labellum with small lateral lobes and a roundish, notched middle lobe, yellow bordered with brown; crest lobed and warted, yellow, with red spots. Brazil. B.R. 33:68. Gn. 10, p. 131; 31, p. 198; 34, p. 87.—Blossoms in spring, the flowers remaining fresh for several weeks.

9. **críspum**, Lodd. Pseudobulbs oblong, sulcate, rough and usually dark brown: lvs. leathery, lanceolate, about 9 in. long: flower-stem 1–1½ ft. high, arched, bearing 20–50 large fls. 1½–3 in. across: fls. shining brown, with few yellow and red marks at the bases of the segments; sepals obovate, obtuse, recurved and undulate, the lateral ones united; petals twice as large, broadly obovate, obtuse, much waved and crisped; middle lobe of the labellum large, rotund-cordate, waved and crisped; lateral lobes small, horn-like. Fls. at various seasons. Brazil. B.M. 3499. B.R. 23:1920. L.B.C. 19:1854. F.S. 21:2147–48. F.C. 2:64. B. 1:26.—Var. **grandiflòrum**, Hort. Fls. very large, the segments edged with yellow.

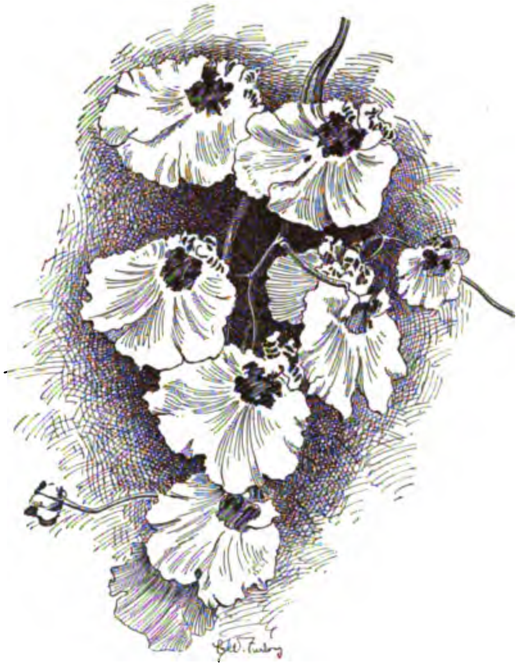
10. **cornígerum**, Lindl. Pseudobulbs oblong, sulcate, 3 in. long, 1-lvd.: lvs. dark green, broadly ovate to oblong, fleshy, ribbed, 4 in. long: panicle about 18 in. long, drooping, branched and crowded with fls. above: fls. small but numerous, yellow, spotted with red; dorsal sepals and petals obovate, concave, undulate, the lateral sepals smaller and united; labellum with long-linear lateral lobes and 2 horn-like processes at the base; middle lobe obovate, subrepand. April, May. Brazil. B.M. 3486. B.R. 18:1542.—A compact free-flowering plant which is very attractive when grown in baskets so that the long racemes can hang over the sides.

11. **cucullàtum**, Lindl. Pseudobulbs oval, 1½ in. long, smooth, becoming ribbed: lvs. oblong-lanceolate, 6 in. long: raceme almost simple, 8–12 in. long, bearing 6–12 fls. 1¼ in. across: dorsal sepals and petals small, oval, greenish, shaded with rose-purple; lateral sepals almost entirely united; labellum cordate-panduriform, with the middle lobe much dilated and 2-lobed, white to rose and spotted with dark purple. Spring. Colombia. F.S. 8:835; 23:2457. I.H. 25:305. Gn. 22:350 (var. *giganteum*).—A species with many varieties, which differ in shape and coloring of the fls. It is one of the coolest of the Andean orchids. Var. **nubigenum**, Lindl. Raceme suberect: sepals and petals white or light purple, with green tips; labellum white, with a purple blotch around the crest. B.M. 5708.

12. **Martiànum**, Lindl. (*O. bícolor*, Lindl.). Pseudobulbs ovate, compressed and ribbed: lvs. oblong, striate: fls. yellow, spotted; lateral sepals united, ovate, acute; petals obovate, concave; middle lobe of the labellum larger than the rest of the flower, 2-parted by the deep sinus in front, clear yellow. Autumn. Brazil. B.R. 29:66.—A beautiful yellow species, with a panicle 2 ft. high.

13. **flexuòsum**, Sims. Pseudobulbs ovate, flattened, 2 in. long: lvs. linear-oblong, 6 in. long: fls. scarcely 1 in. across; sepals and petals small, recurved, yellow, with chestnut bars; labellum yellow, with few reddish spots; side lobes small; middle lobe reniform, notched. Brazil. B.M. 2203. L.B.C. 5:424.—The plant blooms freely at various seasons. The fls. open in succession on a loose spreading panicle about 2 ft. high.

14. **varicòsum**, Lindl. Pseudobulbs ovate, angled, 2–4 in. long: lvs. rigid, linear-lanceolate, 9 in. long: fl.-spikes strong, arching, 3 ft. long, with numerous fls. 1 in. across: sepals and petals small, green, with brownish blotches; labellum very large in proportion to the flower, bright yellow, with a curiously toothed crest; lateral lobes rotund; middle lobe reniform, obscurely 4-lobed. Winter and spring. Brazil.—One of the most attractive. Var. **Rógersii**, Reichb. f. (*O. Ródgersii*, Hort.). Fig. 1524. The best variety. Specimens have borne 150 fls., with the lip over 2 in. across, rich yellow, with a few red bars at base. G.C. 1870:277. F.S. 18, p. 150. F. 1870:25. Gn. 55:1226. G.M. 39:366.



1524. Oncidium varicosum, var. Rogersii (× ⅓).

15. **Phalænópsis**, Linden & Reichb. f. A small-growing plant, with pseudobulbs oblong, somewhat ribbed, 1–2 in. high: lvs. narrow at the base, broadening upward, about 6 in. long: fls. 3–6 on a slender raceme. gaily colored, creamy white, with the sepals and petals barred with reddish purple, and the base of the lip profusely spotted with the same color; sepals and petals quite similar, oblong, acute; labellum pandurate, with 2 rounded lobes in front. Blooms at various seasons, and lasts a long time. Ecuador. I.H. 17:3. Gn. 41:859. J.H. III. 28:515.—A beautiful little plant, worthy of extended cultivation. Much like *O. cucullatum*.

16. **lóngipes**, Lindl. (*O. Janeirénse*, Reichb. f.). Pseudobulbs narrowly ovate. 2-lvd.: lvs. narrow: scape several-fld., equaling the lvs.: fls. on long pedicels; lateral sepals elongate, pendulous, united at the base; dorsal sepals shorter and wider, recurved; petals oblong, plane; all yellowish green, barred with brown; labellum yellow, spotted with brown at the base; lateral lobes small, obtuse; middle lobe transversely broadened, apiculate, the narrow part serrated. Summer. Brazil. I.H. 2:54. B.M. 5193, called *O. longipes*, is *O. Crœsus*, Reichb. f.—A small species.

17. **dasýstyle**, Reichb. f. Pseudobulbs ovate, flattened, strongly rugose: lvs. 4–5 in. long, linear-lanceo-

late: scape very slender, 6–7 in. long, bearing 2–5 fls., each 1½ in. across: dorsal sepals and petals subequal, lanceolate, pale yellow, blotched with purple-brown; lateral sepals larger, united half-way; labellum large, sulfur-yellow, with a blackish purple callus; lateral lobes small, triangular; middle lobe round-fan-shaped, membranous and undulate. Jan., Feb. Organ Mts., Brazil. B.M. 6494.

18. **cóncolor**, Hook. (*O. unguiculàtum*, Klotzsch). Pseudobulbs small, oval-oblong, slightly furrowed: lvs. lanceolate: fls. 1–2 in. in diam., rich yellow, borne on pendulous racemes 1–2 ft. long; lateral lobes united for half their length, smaller than the dorsal sepals and petals, which are obovate; labellum twice as long as the sepals, broad, flat, bilobed, with 2 reddish ridges running down on the base. April–June. Organ Mts. B.M. 3752. I.H. 30:487. R.H. 1881:30. Gn. 13:111.—A plant of close and compact habit, making one of the most attractive yellow coolhouse orchids.

A. *Labellum with a large reniform mid-lobe: lateral lobes small or none.*
B. *Petals much broader than the sepals* ....19. **ampliatum**
20. **excavatum**
BB. *Petals and sepals nearly of the same size.*
C. *Fls. over 2 in. across: labellum large, forming the most conspicuous part of the flower: panicle stout*......21. **tigrinum**
22. **splendidum**
CC. *Fls. medium-sized, numerous, in long, climbing panicles.*
D. *Sepals and petals linear-lanceolate, acute.*
E. *Fls. white and purple*.......23. **incurvum**
EE. *Fls. yellow and brown.*
F. *Column wings very truncate: crest of several interrupted ridges* ....24. **Baueri**
FF. *Column wings rounded, slightly crenulate*.........25. **altissimum**
FFF. *Column wings erose, sphacelate*......................26. **sphacelatum**
FFFF. *Column wings falcate, dentate*......................27. **reflexum**
DD. *Sepals lanceolate: petals spatulate* ....28. **Batemannianum**
DDD. *Sepals and petals linear to oblong, obtuse.*
E. *Color of labellum yellow*....29. **Harrisonianum**
EE. *Color of labellum white*......30. **leucochilum**
AA. *Labellum with the middle lobe variously shaped, rarely reniform, but more so than the lateral lobes, large.*
B. *Fls. rose-colored*............31. **ornithorhynchum**
BB. *Fls. yellow, variously marked and spotted.*
C. *Crest pulvinate, pubescent*..32. **divaricatum**
33. **pulvinatum**
CC. *Crest not pulvinate.*
D. *Apex of labellum deeply 2-lobed* ....34. **Warneri**
DD. *Apex of labellum apiculate, lateral lobes tooth-like*.....35. **maculatum**
DDD. *Apex of labellum merely emarginate, lateral lobes large.*
E. *Middle lobe broadly reniform, clawed*..............36. **Limminghii**
EE. *Middle lobe not clawed, separated from the lateral lobes merely by a sharp constriction*......................37. **cheirophorum**

19. **ampliàtum**, Lindl. Pseudobulbs subrotund, compressed, bright green with purple spots, becoming blackish purple and wrinkled with age: lvs. plane, oblong-lanceolate, 9 in. long: inflorescence a large panicle 1–3 ft. long, with numerous fls., which are yellow, spotted with red at the bases of the segments; sepals and petals small, the former entirely free; labellum reniform, spreading, wavy, 1½ in. across, narrow at the base, with two small lateral lobes and a prominent lobed crest. March–May. Throughout the coast of Nicaragua. B.R. 20:1699.—The flowers are produced in magnificent panicles. In var. **màjus**, Hort., they are half again as large as in the type. F.S. 20:2140. G.C. III. 17:173. Gn. 45, p. 491. G.M. 37:475.

1525. Oncidium tigrinum (O. Barkeri), to show habit.

20. **excavàtum**, Lindl. (*O. auròsum*, Reichb. f. & Warsz.). Pseudobulbs oblong, compressed, 3–5 in. long: lvs. 1½ ft. long, leathery, shining green: panicle 3–5 ft. long, with numerous fls. 1½ in. across, yellow, spotted with brown: sepals obovate, obtuse, free; petals oblong, retuse; labellum sessile, with several broken ridges near the base, pandurate, excavated on the under side; middle lobe rotund, emarginate. Autumn. Peru. B.M. 5293. I.H. 17:34.—Strong plants produce as many as 100 flowers on each panicle.

21. **tigrinum**, LaLlave & Lex. (*O. Bárkeri*, Lindl. *O. unguiculàtum*, Lindl.). Fig. 1525. Pseudobulbs oval, compressed, 2-lvd.: lvs. oblong-lanceolate, thick, 1 ft. long: panicle erect, stout, 3 ft. high: fls. 2½ in. across; sepals and petals similar, lanceolate, undulate, rich reddish brown, with few bars and spots of yellow; labellum yellow, with a very large, orbicular-reniform blade supported on a long claw, lateral lobes oblong. Winter. Mex. I.H. 1:2; 22:221. P.M. 14:97. R.H. 1889, p. 176.—Very much like *O. splendidum*, from which it differs by the longer claw of the labellum having a thick keel, and the oblong lateral lobes of the labellum. Both are among the most showy Oncidiums in cultivation. Var. **grandiflòrum**, Hort., is advertised.

22. **spléndidum**, A. Rich. Pseudobulbs small, round, compressed, 1-lvd.: lvs. leathery, oblong-ovate, 6–12 in. long: fl.-stalk erect, 2 ft. long: fls. 3 in. across; sepals and petals similar, lance-oblong, acute, recurved, yellow-green, with broad brown bands; labellum very large, yellow, the broad claw of the middle lobe expanding into a large reniform blade; lateral lobes small, rotund. Spring. Guatemala and Mex. B.M. 5878 as (*O. tigrinum*, var. *splendidum*). F.S. 18:1825. Gn. 51:1121. R.B. 17:108. G.C. 1871:42; III. 3:108.

23. **incúrvum**, Barker. Pseudobulbs ovate, compressed and ribbed, 2 in. long: lvs. 9 in. long, ensiform, acute: panicle 2–3 ft. long, slender, much branched and gracefully arched: fls. 1½ in. across, numerous; sepals and petals linear-lanceolate, undulate, white, banded with purple; labellum white, with a purple blotch; lateral lobes rotund, small; middle lobe subreniform, concave. Bears numerous panicles in autumn. Mex. B.M. 4824. B.R. 31:64. I.H. 2:49; 29:444 (white variety).

24. **Baùeri**, Lindl. (*O. altíssimum*, Lindl.). Pseudobulbs oblong, compressed: lvs. ensiform, rigid, keeled: panicle with numerous branches and rather dingy fls.: sepals and petals about as long as the labellum, linear-lanceolate, undulate, yellow, with red spots; labellum with 2 spreading lateral lobes and a reniform emarginate mid-lobe, yellow, with a reddish band. Trop. Amer. B.R. 19:1651 (as *O. altissimum*).—A gigantic epiphyte

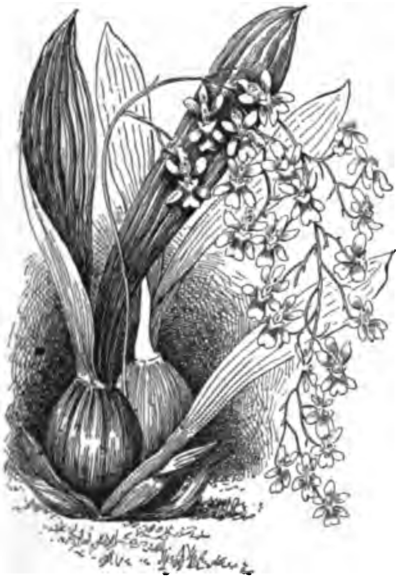
with flower-stems 6–9 ft. long and "lvs. as long." It has been confused with *O. altissimum.*

25. **altíssimum,** Swartz. Pseudobulbs nearly rotund, much compressed and edged: lvs. 1–2 at the top and several at the base of the pseudobulb, ensiform, keeled, 1½–2 ft. long: inflorescence an almost simple, drooping raceme, 4–6 ft. long: sepals and petals free, similar, spreading, linear-lanceolate, undulate, pale yellow, with olive-brown blotches; labellum nearly as long as the petals, fiddle-shaped, with the middle lobe reniform, spreading, yellow, with a brown band near the center, prominently crested. Aug. W. Indies. B.M. 2990. B.R. 22:1851.

26. **sphacelàtum,** Lindl. Pseudobulbs elongate-ovate, compressed: lvs. long, ensiform, apex recurved: scape strict, bearing a many-fld. panicle: sepals and petals linear-lanceolate, undulate, yellow, spotted with brown; labellum about as long as the sepals; lateral lobes auriculate; middle lobe with 2 rotund lobes, yellow, with brown spots at the base. Spring. Honduras. B.R. 28:30.—Var. **grandiflòrum,** Hort., is a better variety.

27. **refléxum,** Lindl. Pseudobulbs ovate, 1-lvd.: lvs. narrowly lanceolate, acute: panicle with its stalk 3–4 ft. long, pendulous: sepals and petals linear-lanceolate, undulate and reflexed, yellowish, shaded with pale brown; labellum with a large, reniform, emarginate middle lobe and rotund lateral lobes, yellow, with few reddish spots on the base. Mex. B. 3:116.

28. **Batemanniànum,** Parmentier. Pseudobulbs large, 4–5 in. long, with sheathing lvs. at the base: lvs. oblong-ensiform, 2 ft. long: scape erect, 6–8 ft. long: sepals lanceolate, undulate, reddish brown, slightly marked with yellow; petals similarly colored, spatulate and very much undulate; labellum brilliant yellow, with the crest marked with brown; lateral lobes small, rounded; middle lobe large, reniform, emarginate. Brazil. F.C. 3:137.—Related to *O. altissimum.*



1526. **Oncidium ornithorhynchum** (× ¼).

29. **Harrisoniànum,** Lindl. (*O. Harrisiànum,* Hort.). Pseudobulbs subglobose, 1-lvd.: lvs. linear-oblong, acute, fleshy and recurved: panicle about a foot high, erect, with the stem and branches gracefully curved: sepals and petals linear, obtuse, yellow, spotted with purple-brown; labellum yellow, longer than the sepals, with small lateral lobes and a subreniform, emarginate middle lobe. Autumn. Brazil. B.R. 19:1569. L.B.C. 20:1917. R.B. 18:253.

30. **leucochìlum,** Batem. Pseudobulbs sulcate, ovate, compressed, 2–4 in. long: lvs. sword-shaped, 1 ft. or more in length: scape 3–4 ft. high, with numerous branches on which the fls. are loosely scattered: sepals and petals oblong, obtuse, green, blotched with reddish brown; labellum pure white; lateral lobes small, rounded; middle lobe broadly reniform, emarginate. Autumn. Guatemala. Batem. 1. F.S. 5:522. P.M. 7:241.—A noble species, with the habit of *O. Baueri.* Panicles 6–9 ft. long. Var. **spléndens** is listed.

31. **ornithorhýnchum,** HBK. Fig. 1526. Pseudobulbs oblong, compressed, 2–3 in. long, 2–3-lvd.: lvs. grass-like, 8–12 in. long: stalks 1 ft. long, slender and arched, many-fld.: fls. scarcely 1 in. across, soft rose-purple; sepals linear-oblong, wavy; petals oblong and a little broader; labellum pandurate, with small lateral lobes and a larger dilated, emarginate middle lobe. Fragrant. Autumn and winter. Mex. B.M. 3912. B.R. 26:10. F.C. 3:136. R.H. 1876:230.—This is an easily grown, free-flowering plant of dwarf, compact habit. Its soft rose-purple color is very delicate and unusual in the genus. Var. **albiflòrum,** Reichb. f. (var. *álbum,* Hort.). Fls. whitish, with only the calli yellow. F.M. 188:398. G.C. III. 16:781. J.H. III. 29:399. G.M. 38:18. There is also a variety called **màjus.**

32. **divaricàtum,** Lindl. Pseudobulbs compressed, each with a fleshy, oval, apiculate leaf: scape 1½ ft. high, with the branches of the panicle extremely divaricate: sepals and petals oblong-spatulate, greenish yellow, spotted with purple toward the base; labellum yellow, spotted with red; lateral lobes large, half-rotund; middle lobe smaller, emarginate. Autumn. Brazil. B.R. 13:1050. L.B.C. 13:1212. P.M. 3:4.—A floriferous species easily recognized by its singular oval, fleshy leaf and the divaricate panicle.

33. **pulvinàtum,** Lindl. Panicle very much branched, in a loose, spreading manner, weak, 8–9 ft. long: fls. yellow, with the sepals and petals blotched with red; segments obovate, acute; the 2 parts of the labellum nearly equal; lateral lobes rotund-crenate and crisp; middle lobe undulate, crest a villous cushion. Summer. Brazil. B.R. 25:42.—One of the largest of the Oncidiums. The fls. last a long time. Var. **màjus,** Hort., is said to be desirable.

34. **Wárneri,** Lindl. (*Odontoglóssum Wárneri,*Lindl.). Pseudobulbs ovate, somewhat angular: lvs. linear-lanceolate: raceme short, few-fld.: sepals oblong; petals a little wider; all white or yellowish, striated with rose-purple; labellum brilliant yellow; lateral lobes subquadrate; middle lobe deeply divided into two rounded lobes. Autumn. Mex. B.R. 33:20 (var. *purpuratum,* Lindl.).

35. **maculàtum,** Lindl. Pseudobulbs ovate, compressed, 4-angled, 2-lvd.: lvs. broadly linear-oblong: fls. 1¼ in. across, yellow, spotted with deep purple; sepals and petals subequal, rather fleshy, ovate-subacuminate; labellum oblong-apiculate, the lateral lobes forming 2 large teeth near the middle; middle lobe ovate, sulfur-yellow, base marked with few red lines, claw with 4 horn-like plates. Winter. Mex. B.M. 3836 (var. *ecornutum*) and 3880. B.R. 24:44. F.C. 2:57 (all as *Cyrtochilum maculatum*).

36. **Límminghii,** C. Morr. Pseudobulbs oval, compressed: lvs. oblong, acute, mottled: raceme 1–2-fld., erect, several times longer than the small lvs.: fls. yellow, spotted and banded with brown; sepals and petals lanceolate, the lower pair larger; labellum with large, auriculate lateral lobes and a transversely broadened, subreniform, emarginate mid-lobe, spotted with red. June, July. Caracas. F.S. 18:1827.—A pretty dwarf plant with the habit of a Sophronitis.

37. **cheiróphorum,** Reichb. f. Pseudobulbs 1 in. long, ellipsoid: lvs. 3–6 in. long, linear-lanceolate: scape bearing a dense panicle longer than the lvs.: fls. about ½ in. across, entirely bright yellow, with greenish sepals; sepals and petals small, rounded-ovate, spreading or reflexed; labellum much larger, with three large lobes, the middle lobe notched. Colombia. B.M. 6278. G.C. 1871:168 (description).

A. *Plants dwarf, scarcely over 8 in. high.*
B. *Labellum with 3 equal lobes*.38. **pumilum**
BB. *Labellum with small lateral and a 4-parted middle lobe*.39. **Crista-galli**
AA. *Plants large.*
B. *Wings of the column narrow, falcate*....................40. **bicallosum**
41. **Cavendishianum**
BB. *Wings of the column fleshy, rotund, reniform, etc.*
C. *Labellum pandurate, with triangular lateral lobes*...42. **Lanceanum**
43. **Carthaginense**
CC. *Labellum reniform, with small blunt lateral lobes*..44. **luridum**

38. **pùmilum**, Lindl. A small plant about 6 in. high, without pseudobulbs, and with oblong, leathery lvs.: inflorescence a small, branched panicle, scarcely longer than the lvs.: sepals and petals obovate, yellow, spotted with brown; labellum yellow, rounded, trifid. Spring. Brazil. B.M. 3581. B.R. 11:920. L.B.C. 18:1732.

39. **Crista-galli**, Reichb. f. (*O. iridifòlium*, Lindl., not HBK.). Lvs. radical, cuneiform-ligulate, 2–3 in. long: fl.-stems several, 1–2-fld., slightly exceeding the lvs.: fls. yellow, with few red spots at the base of the segments and labellum; sepals lanceolate, acute; petals oblong, crisp, much wider; labellum large; lateral lobes oblong-cuneate; middle lobe divided into 4 lobes, of which the inner 2 are smaller. B.R. 22:1911.—A very small, neat plant.

40. **bicallòsum**, Lindl. Pseudobulbs none: lvs. large, oblong-lanceolate, keeled, thick and leathery: panicle many-fld., variable in size: fls. 2 in. in diam.; sepals free, obovate, concave; petals oblong-obtuse, undulate; all rich yellow or honey-colored, bordered with cinnamon color; labellum with small, narrow lateral lobes, and a pair of tubercles for a crest; middle lobe large, transversely expanded, emarginate, subcordate. Autumn and winter. Guatemala. B.M. 4148. B.R. 29:12. I.H. 12:458.

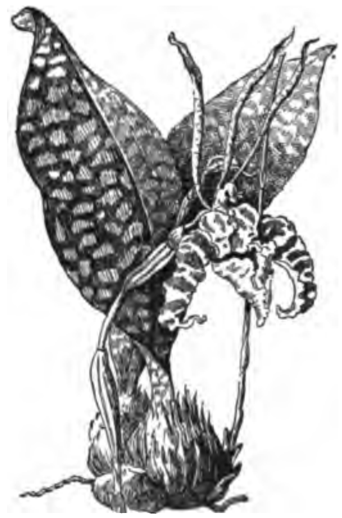
41. **Cavendishiànum**, Batem. Pseudobulbs none: lvs. fleshy, broadly lanceolate, 1–1½ ft. long: scape 4 ft. high, erect, with a dense panicle about 1 ft. long: sepals and petals oblong-obtuse, greenish yellow, with bright chestnut spots; labellum yellow; lateral lobes rather large, spreading, rounded, narrowed to a claw; mid-lobe broadly reniform and deeply emarginate. Guatemala.—Grows very slowly.

42. **Lanceànum**, Lindl. Pseudobulbs wanting: lvs. fleshy, oblong, acute, 1 ft. long and about 3 in. broad: scape stiff, erect, branched above and 1 ft. or more in length: fls. 2–3 in. across, numerous; sepals and petals oblong, obtuse, fleshy, concave, yellow, marked and barred with chocolate-brown or crimson; labellum narrow in the middle, with the 2 lateral lobes forming a hastate base, middle lobe broadly expanded, cuneate. The color of the labellum is variable, usually rose in front, becoming violet toward the base. Summer. British Guiana. B.R. 22:1887. F.S. 18:1842–43. P.M. 4:169. F.C. 2:79. G.C. II. 21:609.—Var. **supérbum**, Hort., is described as a superior variety. Var. **Louvrexiànum**, Hort. (*O. Louvrexiànum*, Hort.). A var. with yellow fls., prettily spotted and marbled; labellum yellow at the base, white in front.

43. **Carthaginénse**, Swartz. (*O. Hénchmanni*, Lodd. *O. ròseum*, Lodd. *O. undulàtum*, Salisb. *O. sanguíneum*, Lindl.). Pseudobulbs obsolete: lvs. solitary, oblong, acutish: panicle 3 ft. long and loose: fls. small, whitish, marked and blotched with red and bordered with yellow; sepals and petals oblong-ovate, free, waved; labellum with horizontal, triangular lateral lobes and a fan-shaped middle lobe, crimson, with a yellow border. Summer. Trop. Amer. B.M. 3806 (as *O. Hunteanum*). F.C. 3:97 (as *O. luridum*, var. *Henchmanni*).

44. **lùridum**, Lindl. Lvs. elliptical, thick, rigid, dull green, 15 in. long: scape slender, 3 ft. high, much branched and many-fld.: fls. nearly 1½ in. in diam., dark green or olive-green, with indistinct darker spots; sepals clawed, undulate, crenate, obtuse, warted on the back, the upper one rotund, the others spatulate-oblong; petals larger and without warts; labellum reniform, almost plane. S. Amer. B.M. 3608. B.R. 9:727.—The panicle is said to grow to a height of 9 ft. A var. **ròseum**, Hort., is said to have rose-colored fls., spotted with white and bordered with yellow. Var. **guttàtum**, Lindl., has yellow fls. spotted with orange. B.R. 25:16.

45. **Papílio**, Lindl. BUTTERFLY ORCHID. Fig. 1527. Lvs. oblong, very leathery, olive-green, mottled with purplish brown, 6–8 in. long; peduncle 2–3 ft. long, flattened and jointed, producing fls. several years in succession: fls. 4–5 in. long and 2½ in. across; dorsal sepals and petals erect-linear, with a small lanceolate expanded portion, brown, with bands of yellow; lower sepals lanceolate-falcate, curved downwards, yellow, with heavy bands of brown, labellum pandurate, usually plane, with the middle lobe rounded, transversely broadened, emarginate, yellow, with a broad band of brown around the margin; wings of the column toothed. Fls. at any season. West Indies. B.M. 2795 and 3733 (var. *limbatum*). B.R. 11:910. L.B.C. 11:1086. F.S. 9:920. P.M. 5:175.—Variable in color of fls. and lvs. Lvs. sometimes green on the upper surface. F.C. 1:12. F. 1842:49. Var. **Eckhardti**, Linden. All parts of the flower very large; sepals and petals golden yellow, barred with red; labellum yellow, with a broad margin of brown. I.H. 30:500.



1527. Oncidium Papilio (× ½).

46. **Kramerianum**, Reichb. f. This species is much like *O. Papilio*. Pseudobulbs rounded, 4–7-angled: stem terete: petals and dorsal sepals shorter than in *O. Papilio*, apex more distinctly dilated; lateral sepals golden yellow, spotted (not banded) with cinnamon-brown, crisp, undulate, finely toothed; labellum very crisp and undulate, finely toothed, pale yellow, with a narrow band of cinnamon-brown spots around the margin; column wings entire. Cent. Amer. F.S. 19:1956. I.H. 41, p. 206.

47. **Jonesiànum**, Reichb. Plants with fleshy, rush-like lvs. 3–12 in. long and usually hanging downwards: fl.-stems 6 in. to 2 ft. long, the largest bearing about a dozen fls. 2 in. across: sepals and petals oblong, wavy, cream-colored, with sepia-brown spots; labellum white, yellow at the base, with a few crimson spots near the isthmus; middle lobe large, subreniform, 2-lobed, wavy; lateral lobes toothed. Fls. at various seasons. Paraguay. B.M. 6982. R.B. 15:7. Gn. 31:583 —The handsomest of the round-leaved species.

48 **Cebolleta**, Swartz. (*O. juncifòlium*, Lindl.). Pseudobulbs very small, each with a single, terete, obscurely furrowed leaf: lvs. 1 ft. long, spreading, harsh in texture: panicle rigid, erect, about 2 ft. high: sepals and petals nearly equal, obovate, greenish yellow, spotted with red; labellum large, bright yellow; lateral lobes

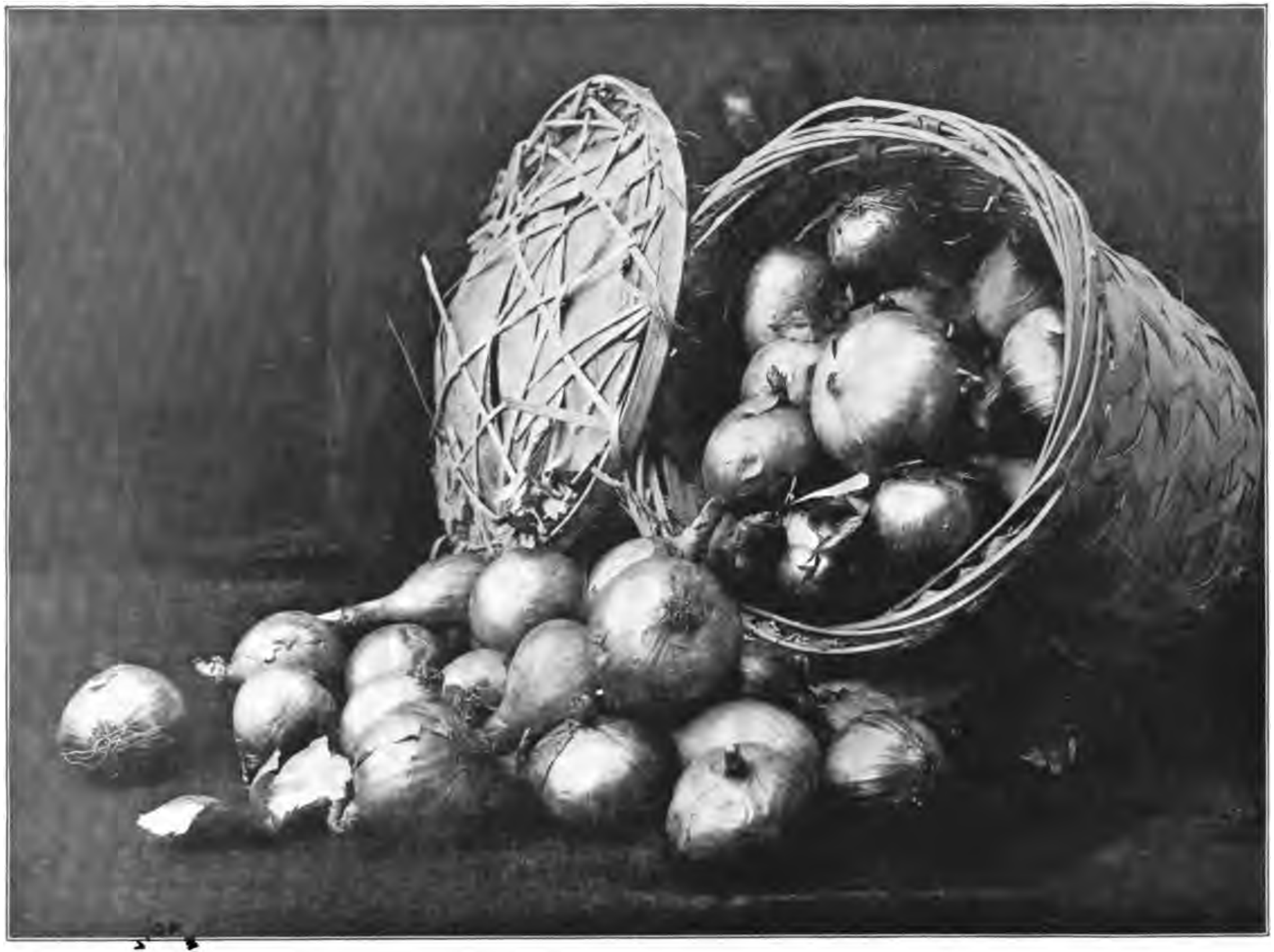


Plate XXII. Onion.

The southern globe type, now popular in the northern markets.

UNI OF MICH.

broadly obovate; middle lobe broadly obovate or subreniform, undulate, notched in front. Spring and summer. Brazil. B.M. 3568. B.R. 23:1994; 28:4 (as *O. longifolium*).

49. **triquètrum**, R.Br. (*Cymbídium triquètrum*, Swz. *Epidéndrum triquètrum*, Swz.). Pseudobulbs none: lvs. few, 4–6 in. long, triquetrous and grooved: scape about as long as the lvs., purplish, bearing a raceme of 10–12 medium-sized fls.: sepals broadly lanceolate, the lower pair united, purplish green; petals ovate, white, tinged with green and spotted with purple; labellum cordate-ovate, constricted near the middle, white spotted with purple; crest orange. Autumn. Jamaica. B.M. 3393.

A supplementary list of synonyms and imperfectly known kinds advertised in America: *O. ansiferum*, Reichb. f. Sepals and petals oblong-obovate, free, crisp; labellum with ligulate lateral lobes and a reniform, emarginate middle lobe, golden yellow, with 2 dark brown bars at the base, flaccid. The sepals and petals are greenish, with yellow tips.—*O. Baldeviàmæ*, Reichb. f. (O. Balderramæ, Reichb. f.). Panicle ample: dorsal sepals rounded, clawed, crisp, yellowish olive-brown with a yellow border; lower sepals longer clawed, cuneate-oblong, unicolored; petals oblong, short-clawed, crisp, nearly complicate, smaller than the sepals, yellow, with brown blotches: labellum hastate, ligulate, obtuse. Summer. Colombia.—*O. Bictoniénse*, Hort. ex-Lindl.=Odontoglossum Sp.—*O. Fórstermanni*.—*O. fuscàtum*, Reichb. f. = Miltonia Warszewiczii.—*O. Gárdneri*, Lindl. (O. Gardnerianum, Hort.). Resembles O. crispum and O. Forbesii. Fls. lemon-yellow, spotted and barred with chestnut-brown on the sepals and petals; labellum broad, yellow, margined with the same color; all segments undulate, crisp. Brazil. G.C. II. 16:86. F.M. 1880:401. This is probably O. curtum, Lindl., which should be referred to this species.—*O. Geertiànum*, C. Morr. (O. cæsium, Reichb. f.). A species probably based on a variety of O. reflexum.—*O. Gravesiànum*, Rolfe. Pseudobulbs broadly oblong-compressed, 3 in. long: lvs. elliptic-oblong, 4 in. long: panicle large, branching: fls. 2 in. across, yellow, spotted with brown; dorsal sepals spatulate; lateral sepals lanceolate-oblong, united at base; petals obovate, wider than the sepals; labellum pandurate, with small spatulate lateral lobes and a broadly orbicular-ovate, undulate middle lobe. Brazil. R.B. 21:73. G.C. III. 11:651. Near O. crispum.—*O. hastàtum*, Lindl. Sepals and petals yellow, spotted with brown; labellum pale yellow. Mex.—*O. lancifòlium*, Lindl. (O. sessile, Lindl. & Paxt.). Pseudobulbs oblong: lvs. short, pale green: panicle much branched and bearing a large number of fls.: sepals and petals large, obtuse, yellow, spotted with cinnamon-brown at the base; labellum large, of the same color. Ecuador.—*O. Lávenderi*.—*O. Lawrenciànum*, Reichb. f. =Brassia Lawrenciana.—*O. murìnum*, Reichb. f. A species with numerous small yellow fls. borne in panicles.—*O. obryzàtum*, Reichb. f. & Warsc. Fls. golden yellow, spotted with brown, borne in a much-branched panicle. Peru. Said to be an elegant winter-flowering orchid.—*O. Reichenbachii*, Lindl. Colombia.—*O. ròseum*, Beer.=Cochlioda rosea.—*O. rupéstre*, Lindl. Fls. numerous, in a branched panicle 2 ft. high, brilliant yellow, spotted with brown. Peru. Said to be desirable.—*O. Russelliànum*, Lindl.=Miltonia Russelliana.—*O. sarcòdes*, Lindl. Pseudobulbs subcylindrical, 3 in. long, 2–3-lvd.: lvs. lanceolate: panicle branched, many-fld., slender: fls. large, yellow, spotted with brown; sepals free, obovate; petals larger, clawed, obovate-spatulate, repand; labellum with small serrate lateral lobes; middle lobe large, emarginate, undulate. Brazil. I.H. 21:165. Near O. ampliatum.—*O. Schilleriànum*, Reichb. f. Trop. Amer.—*O. Schlìmii*, Linden. A large, rampant species, with yellow fls. marked with brown, about 1 in. in diam. Nov. Cent. Amer.—*O. spaculàtum*.—*O. stelligerum*, Reichb. f. Sepals and petals oblong-ligulate, stellate, yellowish, with many brown dots; labellum with short, obtuse-angled lateral lobes, a narrow isthmus, and a cordate, rotund, cuspidate middle lobe, pale yellow, with a darker callus. Mex. Near O. hastatum.—*O. Vólvox*, Reichb. f. Venezuela.—*O. Warszewiczii*, Reichb. f. Pseudobulbs rounded, compressed: lvs. 1 ft. long, thin: scape stout, with an 8–13-fld. panicle: fls. yellow, with purple spots and the middle of the labellum blood-red; upper sepals lanceolate, acute, crisp; lower pair oblong, shorter than the labellum, united; petals oblong, much wider than the dorsal sepals; labellum with auriculate lateral lobes and a reniform bifid middle lobe. Colombia.—*O. Wéltoni*, Hort.=Miltonia Warszewiczii. HEINRICH HASSELBRING.

ONCÒBA (Arabian, *onkob*; name of a North African species). *Bixàceæ*. Shrubs or small trees of tropical and subtropical Africa, sometimes spiny. Lvs. alternate, without stipules: fls. terminal, solitary, white, large for this order, bisexual; sepals and petals 5; stamens very numerous, inserted, in many rows on a fleshy wing beneath the ovary; filaments filiform; anthers linear, 2-celled, attached to the base, erect, opening at the sides; stigma dilated, notched: ovary free, 1-celled; style cylindrical: berry leathery, pulpy within; seeds numerous, used as ornaments by the natives.

Kraussiàna, Planch. A branching shrub without thorns, the older branches having a rough ash-colored bark: lvs. elliptic-oblong, obtuse or subacute, entire, 2 in. long, with midrib, pinnate and netted veins, somewhat pale on under side: peduncles terminal or opposite the lvs., 2–3 in. long: fls. erect, solitary, more than an in. across, white; sepals roundish and very concave; petals twice as long, spreading, with narrow claws, cuneate at base, broadly obovate, with scattered, woolly hairs; anthers pointless; stigma 5–6-rayed: ovary hairy. Procurable in S. Calif. — This makes a very fine pot-plant in a greenhouse temperature, flowering in spring. It is also useful for subtropical bedding. Prop. from ripewood cuttings, also from seeds. Give the plant a sunny position, and plenty of water while new growth is making. M. B. COULSTON and H. A. SIEBRECHT.

ONCOSPÉRMA (Greek, *tumor-shaped seed*). *Palmàceæ*. Stoloniferous palms, with low, very spiny trunks: lvs. equally pinnate; lfts. ensiform-acuminate, entire, equidistant or somewhat clustered, the veins scaly beneath; rachis convex on the back, with a blunt keel above: fr. small. Oncosperma differs from Euterpe in the small, acute sepals: stamens 6–12, the anthers erect; albumen ruminate. Species 6. Trop. Asia.

fasciculàtum, Thwaites. Caudex at length 30–40 ft. high, 5–6 in. in diam.: lvs. 18 ft. long; pinnæ fascicled, 12–18 in. long, 1–2 in. wide, lanceolate, long-acuminate, the tips drooping; sheath 2½ ft., armed and scurfy: fr. globose, black-purple, ½ in. in diam. Ceylon.

JARED G. SMITH.

ONION. Plate XXII. All the Onions of common or general cultivation are forms of one variable species, *Allium Cepa*. This plant is probably native to southwestern Asia, but it has been domesticated so long and has varied so much that its aboriginal form is not well understood. It was grown by the ancient Egyptians. It is grown primarily for its bulbs, but the leaves are sometimes used as seasoning and in stews Under long-continued cultivation and selection, the bulbs have developed into large and shapely organs. Now and then the bulb does not develop and the neck (or stalk just above the bulb) remains relatively thick: such onions are "scullions." Seeds from poorly selected or deteriorated stock may be the cause of scullions: they are to be considered as reverted or run-down forms. Sometimes scullions result from very wet soil, whereby the plants grow too much to top. Seeds grown in the South or in a long-season climate tend to produce plants in short-season regions that do not "bottom" before caught by frost.

The Onion is one of the hardiest of vegetable garden plants. In the southern climates it is grown largely as a winter crop. In the northern states and Canada the seeds are sown or the bulbs planted as soon as the ground can be fitted in the spring. It is always best, if possible, to prepare the ground in the fall in order that the seeds may be sown on the first approach of warm weather. When Onions are grown from seeds, it is essential that the ground be fine and loose, and all surface stones and litter removed. The seeds are small and do not germinate quickly. The young plants are surface feeders. If the seed is sown late or if the ground is droughty, the plants will either perish or make no headway. Land which is foul with weeds should not be planted to Onions, for the young Onion plants cannot withstand such competition. In the old-fashioned gardens, it was the custom to plant Onions in short rows crosswise of raised beds, as in Fig. 1528. This entailed an endless amount of small hand labor and usually resulted in the expenditure of more time and effort than the Onions were worth. The better method is to grow the plants in long rows which are far enough apart to admit of the use of a wheel hoe. Fig. 1529. Even when a small quantity of Onions is desired, it is better to place them all in one row than to have many short rows. With the best of land and management, and with the use of wheel hoes, more or less finger work will be necessary in order to bring the crop to full perfection. The seed may be sown thick in the home garden, and as the young plants begin to crowd, they should be thinned. The plants taken out in the second and third thinnings may be used on the table. Fig. 1530. It is very important that the best grade of seed be used, for the Onion deteriorates rapidly from seed which is not well grown nor carefully selected. There are great numbers of varieties. The most popular standard field kinds are Southport Red and Yellow Globe, and these are also to be advised for the main reliance in the home garden. For early use and for variety, great numbers of kinds may be selected from reliable seed catalogues. Some of the quick-growing southern Onions are excellent for early use.

1528. The old-time Onion bed.

There are two general methods of propagating the Onion—by seeds and by bulbs. Onion seed is ordinarily known as "black seed," although there is no Onion seed which is not black. The main field crop is grown from seeds, as explained in the articles which follow. The Onion seed of the market is produced from full grown and typical bulbs of the desired variety. These bulbs are grown from seed and are kept over winter as other Onions are. In the spring they are planted out in rows two feet apart and as near together in the row as they will stand. They send up a flower stalk which blooms in early summer, and the seed is harvested.

Propagation by bulbs is employed for the purpose of securing early Onions for home use or for the special early-season trade. Until within recent years, all the very early or bunch Onions were raised from bulbs, but recently a so-called "new Onion culture" has come into vogue, which consists in sowing seeds in hotbeds or coldframes and transplanting the young plants. Bulb-propagation is of three general categories: (1) The use of bulblets or "top Onions" which appear on the top of the flower-stalk in the place of flowers; (2) the use of bulbels or separable parts of an Onion bulb, known as "multipliers," or "potato Onions"; (3) the use of ordinary bulbs which are arrested in their growth, known as "sets."

Bulblets, or top Onions, are shown in Fig. 1531. If one of these bulblets is planted in the spring, it quickly produces a young bulb, and the growing bulb maybe pulled at any time and eaten. If allowed to remain in the ground, however, it sends up a stalk (either the first or second year) which bears a cluster of bulblets, sometimes mixed with flowers, on its top. There are two or three strains of top Onions on the market, although the leading ones are the white and the red, these names applying to the color of the bulblets. The so-called "Egyptian Onion" is a top Onion; also the "tree Onion."

1529. The new-time Onion field.

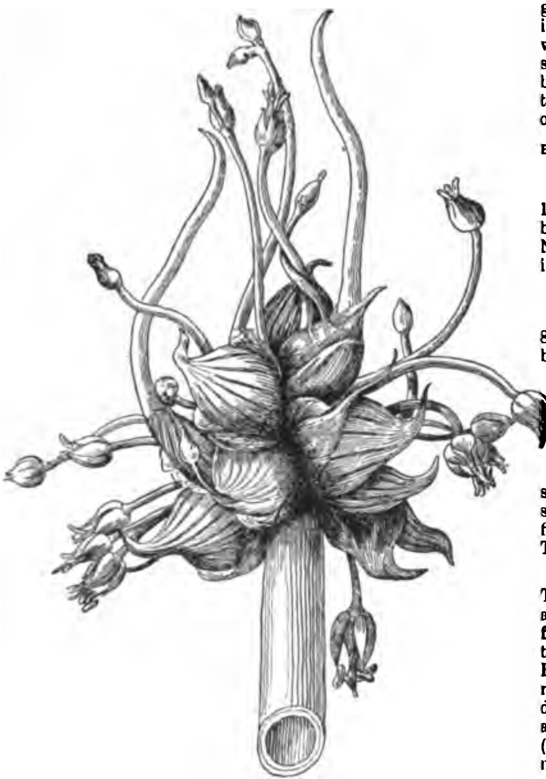
Multipliers are shown in Fig. 1532–3. Instead of containing a single "heart" or core, as in most Onions, it contains two or more. When the Onion is planted, each of these cores or bulbels sends out leaves and grows rapidly for a time; that is, the old or compound bulb separates into its component parts. The growing bulbels may be pulled and eaten at any time. If allowed to remain in the ground, each of these bulbels will make a compound bulb like that from which it came. Sometimes flower-stalks are produced from multiplier or potato Onions. The best results with multipliers are secured when the bulbels are separated on being planted, for each one has room in which to grow. Two or three kinds of multiplier Onions are known, the variation being chiefly in the color of the bulb.

Onion sets are merely ordinary Onions which are arrested in their growth, and when planted will resume growth. They are grown from seed. The seed is sown very thick on rather poor land, so that the young bulbs soon reach the possibilities of their growth: they mature when still very small. These small bulbs or sets are then harvested and kept over winter, and used for planting the following spring. When planted they grow rapidly and may be pulled and used for the table. If allowed to remain in the ground, they send up flower-stalks and produce seeds, as common Onions do. Sets are not allowed to seed, however, since the seeds from sets would probably produce an inferior race of Onions. Any variety of seed-bearing Onion may be grown and propagated as sets, although there are relatively few that give uniformly good results. In the trade, Onion sets are usually designated as yellow, red or white. In order to secure good results from Onion sets, it is essential that the sets be small and firm. They should not be over one-half inch in diameter, if they are of the best. If they are much larger than this, they tend to run to seed rather than to produce bulbs. Sometimes the very small and inferior Onions are saved from the regular crop and are used as sets the following spring. Such sets are generally known as "rareripes." Usually they do not give the best results.

The varieties of Onions are numerous. In 1889 (Annals Hort.) 78 varieties of "seed" Onions were offered by American dealers, and also about 20 kinds of multipliers, potato Onions and sets. For purposes of careful scientific study, the varieties may be classified into geographical races, but for purposes of description they may be assembled into groups characterized by such arbitrary features as form and color of bulb.

1530. Bunch Onions from the early spring sowing.

Goff (6 Rep. N. Y. State Exp. Sta., for the year 1887), classifies first by shape of bulb and then by color. He makes four primary groups: bulb oblate, spherical, top-shape, oval or pear-shape. Each of these groups is divided in three sections: color white, yellow or brownish, red or reddish. Another classification (Bailey, Bull. 31 Mich. Agric. College, 1887), makes three primary sections on methods of propagation: propagated by division (multipliers), by bulblets or "tops," by seeds (or sets). The last section (seed Onions) is divided into bulbs silvery white and bulbs colored, and these groups are again divided on shape of bulb.



1531. Top Onions (× ½).

Aside from the chapters on Onions in the vegetable-gardening manuals, there are special treatises, as Greiner's "Onions for Profit," and "The New Onion Culture," Greiner and Arlie's "How to Grow Onions," and the Orange Judd Company's "Onion Book."

The cultivated onion-like plants may be named under six species, as follows:

A. *Leaves terete and hollow.*

B. *Plant annual or biennial, the bulbs evident.*

Allium Cèpa, Linn. COMMON ONION. Bulbs various, but distinctly rounded at top and bottom: scape tall and stout (usually 2–3 ft.), enlarging in the middle, glaucous, much exceeding the large soft hollow leaves: fls. in round umbels (Fig. 1534) white or blush. Persia and adjacent regions.

Var. **bulbellifera,** Bailey. Top or tree Onion.

Var. **múltiplicans,** Bailey. Multiplier or potato Onion.

Allium fistulòsum, Linn. WELSH ONION. CIBOULE. Fig. 1535. No distinct bulb, but only an enlargement at the base: lvs., scape and fls. much as in the Common Onion, except that the plant is usually lower when in bloom and the leaves are more clustered. Siberia. B.M. 1230.—Grown for its leaves, which are used as seasoning. It is as hardy as the Onion. It is grown preferably from seeds, but the roots may be divided. The seeds are usually sown in the fall, unless the climate is severe, and the leaves are ready for early spring use.

Allium Ascalónicum, Linn. SHALLOT (which see). A small plant, with short awl-shaped leaves, and an umbel of lilac fls., but distinguished chiefly by the small oblong-pointed clustered bulbs. These bulbs are borne on a common disk, forming a more or less compact compound bulb that reminds one of a multiplier onion or garlic. It is native to Syria.—The Shallot is rarely seen in this country. It is grown for the little bulbs or "cloves" which are used as Onions are. The young leaves are sometimes used for flavoring. The bulbs or cloves may be planted in early spring, the same as onion sets. The true Shallot rarely blooms. A small strain of Onion is often known as Shallot.

BB. *Plant truly perennial, producing a dense sod-like clump.*

Allium Schœnóprasum, Linn. CIVE (which see). Fig. 1536. One ft. or less high, in a tough clump, scarcely bulbous, producing umbels of rose-purple fls. in spring. N. Eu. and the northern part of N. Amer. Grown for its leaves, which are used for seasoning.

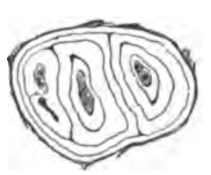
AA. *Leaves flattish, not hollow.*

Allium sativum, Linn. GARLIC (which see). Fig. 894, page 628. Bulbs small, breaking up into many small bulbs or "cloves:" lvs. very narrow, keeled: fls. purplish, but usually not forming or replaced by bulblets. Eu.—Grown for the bulbs, and cultivated like Onions grown from seeds.

Allium Pórrum, Linn. LEEK (which see). Fig. 1537. Strong, robust plant, with the simple bulb little thicker than the stout neck: lvs. very broad and strongly conduplicate or keeled: scape produced the second season, bearing a large umbel of white or blush fls. Eu. Grown from seed, after the manner of Onions. The leaves and bulb are eaten. L. H. B.

THE NEW ONION CULTURE (*Transplanting Process*).—The idea of raising Onions by growing seedlings in beds and transplanting to the open, which are the essential features of what has been termed "the new Onion culture," is not new. It has long been put in practice in the Bermudas, among the Portuguese growers in California, and in various places in Europe. This, however, does not detract from the credit due to the writer, as well as to Prof. W. J. Green, of Ohio, for the rediscovery (about 1889) of this old, but in their localities and in most portions of the United States before that wholly unknown, plan of Onion-growing. There are only few, if any, modern innovations which have left an equally deep impression on our garden practices. The transplanting method is admirably adapted to the character of the large foreign Onions, especially those of the Spanish type, and by it the American grower is enabled to produce bulbs in every way the equal of those large sweet Onions which are imported from Spain and other foreign countries, and sold in our groceries at 5 to 10 cents per pound. A portion of the Onions now palmed off on the unsuspecting buyer in various places as "imported Spanish" are really nothing more than these home-grown bulbs of the Prizetaker variety, and the buyer is not the loser by any means. This Prizetaker is perhaps the best of this class of Onions to be grown by the transplanting process at the present time—large, of good shape, perhaps a little darker in color than the imported Spanish, and its equal in mildness of flavor. The newer Gibraltar is still larger, milder, a little later,

1532. A multiplier Onion.



1533. Section of a multiplier Onion.

not as good a keeper, but altogether one of the best Onions which the home grower, as well as the market-gardener who can sell his crop before late fall and at good prices, could produce.

Start the plants under glass (preferably in greenhouse) during January or February, sowing seed rather thickly in drills an inch and a half or two inches apart, and using about an ounce of seed to ten square feet of bed surface. The soil should be sandy and very rich. Keep the plants in good growth, and as soon as the patch outdoors can be properly prepared in spring, set the seedlings in rows about 14 inches apart, and from 3 to 4 inches apart in the rows. Little hand-weeding will be necessary, but the wheel-hoe should be used freely. We also grow a portion of our green or bunching Onions in this way. For that purpose the plants are set more closely in the rows, say not over 2 inches apart. Seed of the Prizetaker is mostly grown in the United States, while that of the Gibraltar is as yet all imported.

1534. Onion in flower.

T. Greiner.

Commercial Onion Culture in the North.—*Soil.*—The soil should be a rich, moist, but not wet, loam with a subsoil of clay, or close compact sandy loam, not coarse gravel, as that lets the water leach out too quickly. Onions will stand a large amount of fertilization, and there is little danger of getting the soil too rich. Soil that has been under cultivation for three or four years at least is much better than new land. The tendency of the latter is to produce too much top-growth and improperly ripened bulbs.

To prepare the soil, plow 10 or 12 inches deep, if the soil is of sufficient depth, or down to the subsoil. Care should be taken not to turn up much subsoil, or the crop will not mature evenly.

Fertilizers.—If the soil is poor, plow in 5 to 10 cords of stable manure to the acre, and spread on an equal amount of well-rotted manure after plowing, to be harrowed in. Unleached hard wood ashes is also a good fertilizer, especially on rather dry land, as it aids in the conservation of moisture. The action is quick, which makes it valuable where a little of the subsoil has been turned up in plowing, giving the young plants a good start, when, without it, they would be too light-colored and weak in growth. Ashes should be spread as evenly as possible, 75 to 100 bushels per acre on the ground after plowing, and harrowed in.

Tillage.—The harrowing should be thorough, using some kind of a disk or spring-tooth, for the first time over, with a Meeker or some other smoothing harrow for the finish. It is impossible to get a good even stand of plants if the ground is rough or lumpy, while those that do grow are weak and puny on rough ground. Hand-raking is sometimes necessary to insure germination of seed in a satisfactory manner.

Drainage.—The drainage must be nearly perfect to get best results. There should be no hollow places in the beds. Even on a sloping piece of land, the dead furrows or alleys should be kept open. If there is a natural sag in the land which cannot be surface-drained, it is often practicable to underdrain so as to get satisfactory results; for there is no crop grown in the ordinary market-garden which will pay a larger percentage of return for underdraining, in nearly all locations. If the foliage is of a light color, and the crop does not ripen evenly, an underdrain will usually correct the trouble. The time to drain is when the ground is being prepared for planting, not after a heavy rain, when water is standing in pools over the field.

Onion Seed.—There are a few growers who can profitably grow their own seed, but the masses should buy. This should be done early, so that there may be no delay at planting time, and also that one may get the best stock obtainable. If one wants 10 pounds or more it is sometimes advisable to order from some one of the large seed houses of the country, but if there is a reliable local dealer who buys seed in bulk, go to him and make your wants known and you can often do better than to send direct to the large seed house, even on quantities of 50 to 100 pounds. Be sure to know where the seed comes from, and if possible test it before planting. In any case always buy the best seed obtainable, no matter if it costs double the price of other stock.

The sowing of the seed should be done with one of the standard garden seed drills, the first essentials of which are that the machine can be regulated to sow evenly and in the quantity desired without clogging. The machine should open a row, sow, cover, roll, and mark the next row, all at one operation. The machines which have a sliding piece at the bottom of the hopper, which opens and closes a diamond-shaped opening, are the best, as the operator can regulate exactly the amount of seed sown.

The seed should be sown in rows 12–14 in. apart, and at the rate of 3½–4½ pounds per acre, according to soil and seed. A soil which produces heavy tops requires less seed than the drier, sandy soil which grows small tops. The plants should stand from 1–3 in. apart in the row. The seed should be sown from ½–1 in. deep, according to soil.

Tillage should begin as soon as the plants are up enough for the rows to be seen. Begin with a double-wheel straddle cultivator if one is at hand, setting the knives as closely as can be worked without covering the young plants, and continue as often as necessary to keep weeds destroyed and the ground loose on top until the plants are too large to get through. The last time through may be done with a single-wheel machine, which will throw a little earth up to the plants. A single-wheel machine may be used throughout the season, but the double-wheel is preferable for the first part of the work.

A hand-weeder may be used with profit after the young plants have gotten 3–5 in. high. This works two rows at one passage, stirring the soil in the rows where the wheel-hoes do not work, and greatly reduces the amount of hand-weeding to be done. Of course, hand-weeding must be done as often as necessary to keep the beds clean.

1535. Allium fistulosum—Welsh Onion.

Harvesting may be done in the following manner: If the crop ripens evenly, so that there are no green tops standing, the topping can be done most rapidly before the Onions are pulled. By using a thin, sharp knife, taking the dry tops in one hand and cutting from the person, the work can be done quickly and well. Be careful not to tear the skin down the side. The length to cut the tops is a point of importance and must not be overlooked. If the tops are left too long they have a ragged appearance, and if too short, there is danger of causing the Onions to rot in the tops, because of bruising or because of water having gone to the inside of the Onions. The proper length is about half an inch from the bulb; or, take an Onion by the top, with the thumb and forefinger close to the bulb, and cut the top close to the fingers. The pulling may be done by hand, but a puller made to fit a hand-cultivator is much more rapid and does not injure the bulbs. The puller is simply a knife with one or more fingers to move the bulbs slightly as the roots are cut. In light, dry soil it works very well without any fingers.

Many growers prefer to pull the Onions first, allowing them to dry a few days before topping. This is what should be done if the tops do not dry evenly, or if the crop is late and needs to be hurried; and is all right in any case, though not quite so rapid as the other way.

Storage.—After the Onions are topped they should be gotten under cover as soon as possible. Let them dry a day or two if the weather is favorable and then pick them up and store in the curing shed. If allowed to lie too long on the ground the skin peels off too much. The shed should have doors or ventilators at each end from top to bottom, so that the air can pass through freely and be free under the floor. If the floor is tight, with no circulation under it, lay some 2 x 4 scantling on the floor and lay a loose board floor over them without nailing; then take some pieces of 2x4 sawed just 1 ft. long and nail them to the floor at even distances for posts to carry stringers for the next floor. Use 2x4 for the stringers; set them on edge, nail them to the posts and all is ready for the Onions. This gives a space of 16 inches. Fill 12 inches (the length of the posts) and leave the 4 inches for air space. Lay another floor and proceed as before, being careful to get the upper posts directly over the lower ones, or the stringers will break after two or three floors are in.

In handling the Onions, bushel boxes are the most convenient. Pick them up in common baskets, leaving all small, defective, or odd-colored bulbs on the ground, to be picked up separately and sorted as occasion may require. Dump in the boxes, then drive along the side of the bed with a platform wagon, and load. Have a screen about 4 ft. long by 2 ft. wide made of narrow strips ½–1 in. wide and about 1 in. apart. Put legs on one end about 14 or 15 in. long and on the other end long enough to give it a sufficient incline to make the Onions roll down freely. With an old coffee sack make a bag like a sheet hung by the corners with hooks, to hang under the screen, in order to catch the dirt and leaves. Carry the boxes of Onions directly from the wagon to the screen and pour them over it. This will take out all the dirt and most of the loose leaves, and make the Onions come out of the shed in much better shape. They should lie in the shed until they are dry enough to peel off another skin, and rattle and crackle when the arm is run in among them.

1536. Allium Schœnoprasum—Cive.

If all has gone well the crop should average 500 bushels to the acre on good land, or 600 bushels on very rich land, and 700 or 800 bushels on a single acre selected from the best part of a ten-acre field.

Marketing.—There is an old saying, "The time to sell is when someone wants to buy." This is a very good rule to apply, unless one is prepared for cold weather or is reasonably sure of an advance in price. In a general way it is best to ship in sacks of even size and not too large, one and three-fourths to two and one-fourth bushels. These points must be governed by the market. In sacking to ship, always throw out all defective bulbs and all of another color. In size down to about 1½ to 1¾ inches in diameter is a good scale to use in a general way, but this point must also be governed by the market. Sell by sample as far as possible.

Varieties.—There are three varieties of Onions which take the lead clearly above all others in the big markets of the country,—the White Globe, Yellow Globe, and Red Globe. These come under different names, as Southport Yellow Globe and Michigan Yellow Globe, but the object in view among seed-growers is to get bulbs as nearly globe-shaped as possible. The skin should be thick and two or three layers deep, to prevent bruising.

1537. Leek—Allium Porrum.

IRVING C. SMITH.

ONION CULTURE IN THE SOUTH.—Twenty years ago Onion-growing from seed was not considered practicable, and by many it was considered impossible south of the Potomac. The introduction of varieties from South Europe and more careful attention to details of the work have made Onion-growing not only possible but often exceedingly profitable.

The eastern South consumes large quantities of the mild forms, such as the Bermudas. In the markets at Jacksonville, Fla., these are sold by the piece, frequently retailing at 5 cents and 10 cents each. Nowhere in the South are Onions grown exclusively on an extensive scale, but they form a supplementary crop, or may be grown extensively at times. The southern Onion-grower must keep in close touch with the northern and foreign Onion markets. As there are no extensive cold storage plants, the crop must be sold soon after ripening. The extensive Onion-grower of this section must therefore keep his land in proper tilth and wait for the year when the price of Onions will warrant his planting.

Soil.—The soil should be alluvial, sandy, and of a fine texture. A level tract, freed of all debris, and one that can be plowed deeply, is desirable. In the coast region such land may be obtained in great abundance. It is frequently used for vegetable-growing, but large areas are still uncleared or are used for farm crops. In the hilly regions of the interior, Onion lands must be sought mainly along rivers or old river beds.

Fertilizer.—Undecomposed vegetable matter should not be applied immediately preceding the crop. Even cotton-seed meal should be used three weeks or more before the seed is sown and then carefully incorporated with the soil where the rows are to be, or if the rows are to be a foot or 14 inches apart the cotton-seed meal may be sown broadcast and cultivated in.

When the land is deficient in the three ingredients considered essential in fertilizers, the following formula will supply the approximate proportion taken off by a crop of Onions:

Nitrogen	5%
Phosphoric acid, available	6%
Potash	9%

From one to two tons of the above formula will not be found excessive, but the amount that will give the greatest profit will be different on each field.

The following table gives the amounts of different substances which are required to give the desired amounts of each of the three elements:

Nitrogen.	1,000 to 3,200 lbs.	cotton-seed meal.
	1,400 to 2,800 lbs.	guano.*
	1,000 to 2,000 lbs.	dried blood.
	700 to 1,400 lbs.	nitrate of soda.
	500 to 1,000 lbs.	sulph. ammonia.
Phos. acid	1,200 to 2,400 lbs.	acid phos.
	1,000 to 2,000 lbs.	dissolved bone.
Potash...	2,200 to 4,400 lbs.	kainit.
	700 to 1,400 lbs.	low-grade sulfate of potash.
	360 to 720 lbs.	high-grade sulfate of potash.
	360 to 720 lbs.	muriate of potash.

*If guano is used, reduce the potash 33 per cent and the phosphoric acid 50 per cent, since guano contains large percentages of these elements.

Seeding.—Seed-sowing in the field occurs in the upper districts as early as the first of April or a little earlier, in the central district about the last of February, while in the Gulf region it may occur late in fall or any time during the winter, being gauged largely by the time required for the variety to mature, and the market to be met. It is a good rule to put on an abundance of seed, about twice as much as recommended in general, especially in the Gulf region. Many fields suffer from deficient stand more than from any other cause, and in some years it is the only cause for an unprofitable crop.

Sets.—Good crops may be grown from sets, but the labor involved and cost of the "seed" is usually so great as to deter many from planting them. In using sets they should be separated into three or four grades, the largest size maturing earliest and the smallest last. In most cases the smallest sets grow such inferior Onions that they would better be discarded. This takes for granted that the sets were all grown at the same time and from the same seed in one field.

Growing Sets.—Nearly all the sets used in the South are shipped in, while they may be grown as well here as anywhere. In the Gulf region there is time enough to grow a crop of sets after the northern crop has been harvested and marketed. Thus in case of shortage in northern-grown sets, it is entirely practicable to ship the seed south, grow sets, and ship sets back in time for spring market.

The New Onion Culture.—Much has been written and spoken about raising the plants in a seed-bed and then transplanting to the field. While this may be practiced successfully, the greater quantity of Onions is raised by the old-fashioned method, i. e., by seeding in the drills where the plants are to mature bulbs.

1538. Creole Onion.

In certain localities it is advantageous to plant out a seed-bed before the general field will permit working, and then transplant as soon as all conditions are favorable. In the upper districts of the South, seed may be sown in hotbeds as early as the first of February, and the plants may usually be set out by the first of April. In the central South, seed may be sown in protected coldframes as early as the middle of December, or in an open bed in February. The earlier plants may be transferred to the field by the last of February, or as soon as danger from frosts is past. In the Gulf region the seed may be sown during the fall in an open bed, and transplanting to the field may occur when plants are of proper size and favorable condition of weather prevails.

Harvesting is often attended with considerable difficulty, and in some cases special drying houses have to be constructed to secure the crop in first-class condition. The crop is a perishable one, and must be pulled, gathered and shipped in as short a time as possible, when sufficiently mature.

There seems to be no generally accepted plan for marketing, the crop being placed in boxes, barrels or bags for shipping.

Varieties.—The following varieties have given good crops in the hands of expert growers and may be recommended for the entire South: White Bermuda, Red Bermuda, Prizetaker, Yellow Danvers, Giant White Italian, Giant Rocco, and Large Tripoli. Other varieties than those named here have given as good or better returns, but do not seem to have been so generally successful. In addition, are Creole (Fig. 1538) for Gulf region and Red Wethersfield for central and upper district.

Diseases.—Black Mold (*Macrosporium Porri*): This disease spreads rapidly over the field, especially late in the season. Some good may be done by spraying with Bordeaux mixture, but its application is limited almost to the diseased portion.

Smut (*Urocystis Cepulæ*): The name of this fungus, smut, describes it fairly well. About all that can be done is to subject the field to rotation, and to sow seed from smut-free districts. Some years nearly all southern-grown Onions brought to market will be more or less infected.

Rotting is especially severe in wet seasons when the crop cannot be properly handled, and is caused by a number of fungi. Best preventive is to store in a dry place, and consume as soon as practicable.

Insects.—Onion fly, or Onion maggot, is one of the most severe pests when it enters the field. There seems to be but little encouragement in combating the pest. It often leaves the field as mysteriously as it appeared. This disappearance has been coincident with the application of some supposed remedy, and has consequently led to the recommending of unreliable remedies. A thorough application of ground tobacco stems down the row seems to act as an insecticide and a repellent, besides being of value as a fertilizer.

Thrips: These insects attack the leaves at times, and become so numerous as to cause the tips to turn brown and finally destroy the whole leaf. Besides the insect injury they open the way for such fungi as Macrosporium. This insect may be treated successfully with kerosene emulsion, tobacco decoction, resin wash and possibly with kerosene-water mixture. P. H. Rolfs.

ONION, SEA. *Urginea maritima;* also applied to *Ornithogalum caudatum.*

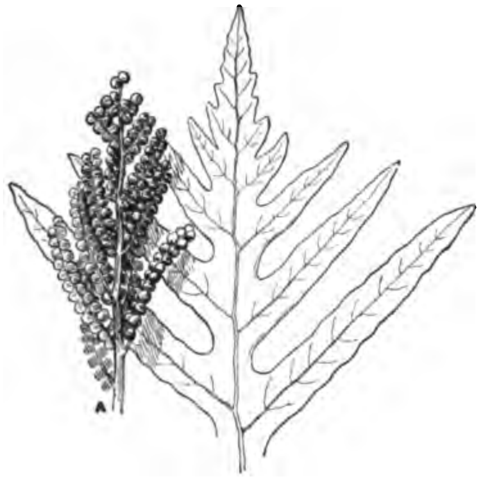
ONÓBRYCHIS (Greek, *asses' food*). *Leguminòsæ*. This genus includes the forage plant called Sainfoin or Holy Clover. It is a perennial herb, which grows a foot or two high, and has numerous small, oblong lfts. forming an odd-pinnate leaf, and spikes of light pink fls., borne in summer on long, axillary peduncles. Its stipules are thin, brown and pointed. The pod is semi-circular, flattish, wrinkled, and bordered with short prickles or teeth. Sainfoin requires a limestone soil, and in the U. S. is grown chiefly in the southern states. In some sections it is considered indispensable, as it increases the flow of milk. The seeds are thought to be more nutritious than oats, and are eaten by fowls. A hundred pounds of seed is sown to the acre.

viciæfòlia, Scop. (*O. sativa,* Lam. *Hedýsarum Onóbrychis,* Neck.). SAINFOIN or SAINTFOIN. HOLY CLOVER. Described above. Eu., Asia. For a picture and further information, see Bull. 2, Div. Agrost. U. S. Dept. of Agric., by Jared G. Smith.

ONOCLÈA (Greek *closed vessel;* alluding to the closely rolled sporophylls). *Polypodiàceæ.* A small genus of coarse ferns of north temperate regions, with creeping rootstocks, anastomosing veins and two sorts of leaves, the segments of the sporophylls being closely rolled about the sporangia into bead-like bodies. For *O. Struthiopteris,* see *Matteuccia.*

sensíbilis. Linn. SENSITIVE-FERN. Fig. 1539. Our native species, with broad triangular lvs., growing in low, wet places. L. M. UNDERWOOD.

Onocleas are tenacious of life, and will grow under almost any conditions, especially *O. sensibilis,* but they prefer a moist, rather heavy loam, in a cool but not necessarily shaded position. *O. Struthiopteris* (a *Matteuccia*) in the sunny border is likely to burn during severe drought. It is a suitable deciduous fern for the greenhouse, and may easily be had in foliage before their natural season. F. W. BARCLAY.



1539. Sensitive-fern—Onoclea sensibilis.
Fruiting frond at A.

ONÒNIS (old Greek name of dubious meaning). *Leguminòsæ*. REST-HARROW. About 60 species of half-shrubby or rarely shrubby herbs, natives of the Mediterranean countries, annual, biennial or perennial. Lvs. usually pinnately trifoliolate, the stipules attached to the petiole: fls. yellow, purple, pink or rarely white, solitary, 2–3 in the axils or in peduncled racemes; calyx bell-shaped, 5-parted, deeply cut, narrow; standard large, striped; stamens united in a tribe, the members sometimes partly free; pedicel awn-like: pod usually swollen, few-seeded, without foot-stalk.

A. *Fls. in groups of 2–3, rose-colored.*

rotundifòlia, Linn. ROUND-LEAVED REST-HARROW. A neat, attractive, shrubby, hardy plant 1½ ft. high. Lvs. trifoliolate; lfts. subrotund to ovate, serrate: peduncles axillary: racemes 2–3 fls.: fls. pea-like, bright rose, not bracted; standard striped with lines of a deeper shade. Of easy cultivation in border and rockery, not liking too much shade. Prop. by division or seed. Summer. B.M. 335.

AA. *Fls. solitary, yellow.*

Nàtrix, Linn. GOAT ROOT. YELLOW-FLOWERED REST-HARROW. Low, much-branched perennial: stem 1–1½ ft. high: lvs. trifoliolate; lfts. elliptical or oblong, serrated near the apex or sometimes entire; stipules large: fls. axillary, the standard finely striped with red. Midsummer to fall. B.M. 329. M. B. COULSTON.

ONOPÓRDON (ancient Greek name). *Compósitæ*. The Scotch Thistle, *O. Acanthium*, is a vigorous biennial plant, growing 5–7 ft. high, with cottony white, spiny foliage, and heads of pale purple fls. 1½–2 in. across, borne singly on the branches. It is not advertised for sale in America, but is sometimes cultivated for "auld lang syne," and occasionally it is used with striking effect by some lover of hardy plants. It is then placed against a background of dark shrubbery, which sets off the silvery foliage and bold habit of the Scotch Thistle. The plant is rarely found growing wild in the Atlantic States, having come from Europe. The Scotch Thistle will probably never be a weed of the first importance in America, as is the Canada Thistle. Nevertheless, care should be taken not to let it go to seed. A white-fld. Scotch Thistle was advertised in Germany in 1894 as a horticultural novelty.

Onopordon is a genus of about 12 species of coarse, woolly, Old World herbs, with stout stems winged by the decurrent bases of the lvs., which are large, alternate, prickly, dentate or pinnately cut: involucre globose, the bracts imbricated in many series, and in some cases spiny: receptacle flat, fleshy, honeycombed, not bristly: pappus not plumose, but with bristles in several series.

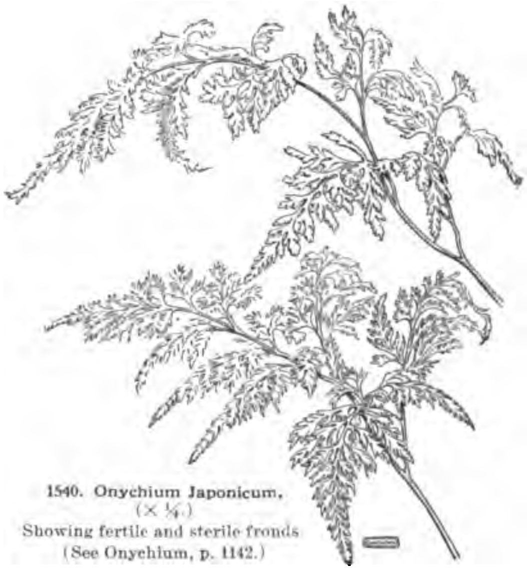
Acánthium, Linn. SCOTCH THISTLE. Much-branched, 3–9 ft. high: lvs. oblong, lobed and dentate, acute, the lower often 1 ft. long. July–Sept. B.B. 3:491. Gn. 46, p. 9. R.B. 20, p. 200. Var. **álba,** Hort. Gt. 45, p. 107.—The Scotch Thistle is often called the Cotton Thistle; sometimes also Argentine, Asses', Down, Oat, Queen Mary's or Silver Thistle. W. M.

ONÓSMA (*onos*, an ass, and *osme*, smell; the odor reputed to be liked by that animal). *Borraginàceæ*. About 70 species of bristly hardy herbs or undershrubs, with long, narrow, alternate lvs. and one-sided, simple or cymose, bracted racemes: the fls. yellow or purple, tube-like, or inflated on one side, sessile, or with short pedicel; calyx 5-parted or cut; corolla-throat dilated or contracted; lobes 5, very short; stamens 5.

stellulàtum, Waldst. & Kit. GOLDEN-DROP. Cult. only in var. **Taùricum** (*O. Taùricum*, Pall.). Stems branching from ground: lvs. linear-lanceolate, with revolute edges; scape branching, leaning, 6–9 in. high; raceme terminal, pendulous: fls. yellow, tubular, expanding above, 8–12 in a raceme, 1½ in. long. July, Aug. Perennial. Succeeds well on high ground or on sunny rockery, with light, open, deep soil. Prop. by cuttings generally, or by seed. B.M. 889. G.C. II. 16:21. J.H. III. 35:11. Gn. 50, p. 251.

J. B. KELLER and M. B. COULSTON.

ONOSMÒDIUM (like *Onosma*, a European genus of this family). *Borraginàceæ*. FALSE GROMWELL. Five or 6 species of North American and Mexican branching herbs, generally perennial, bristly, 1–4 ft. high. Lvs. oblong, sessile, ribbed-veined: fls. white, greenish or yellowish, in long, erect, leafy, raceme-like clusters; corolla tubular or oblong-funnel-shaped, with throat naked, the lobes erect, acute; the sinuses more or less inflexed; style filiform or capillary, very long; stigma exserted before the corolla opens: nutlets ovoid or globular, bony, smooth and polished, white. Closely related to Lithospermum.



1540. Onychium Japonicum. (× ¼.)
Showing fertile and sterile fronds
(See Onychium, p. 1142.)

Caroliniànum, Torr. Stout, branched, 1–3 ft.: lvs. ovate-lanceolate or oblong-ovate, sessile, 5–9-ribbed, 2–4 in. long: fls. yellowish white. June. Can. and western N. Y., west and southward.—Offered by western dealers in hardy plants. Prop. by seeds. M. B. COULSTON.

ONTARIO. See *Canada.*

ONYCHIUM (Greek, *onyx*, a claw; referring to the shape of the lobes of the lvs.). *Polypodiàceæ.* A genus of small, mainly Asiatic ferns, with the sori arranged on a continuous linear receptacle, as in Pteris, but with narrow segments in which the indusia extend nearly to the midrib. For culture, see *Fern.* The orchids occasionally advertised as Onychiums are Dendrobiums.

auràtum, Kaulf. Lvs. ovate, a foot or more long by half as wide, quadripinnatifid, with membranous indusia and abundant sporangia of a golden color; divisions of the sporophylls pod-like. India and adjacent islands.

Japónicum, Kunze. Fig. 1540. Lvs. ovate, a foot or more long by half as wide, quadripinnatifid, with pale indusia and brown sori; divisions of the sporophylls linear-mucronate, similar to those of the sterile leaf. India, China, and Japan.

L. M. Underwood.

1541. Ophioglossum vulgatum.—Adder's Tongue.

OPHÈLIA. See *Swertia.*

OPHIOGLÓSSUM (Greek, *serpent's tongue*). *Ophioglossàceæ.* A genus of small, fern-like plants of wide distribution, with a more or less elongated terminal spike formed of two rows of coalescent sporangia, and bearing a single leaf at or below the middle of the stem. Rather difficult of cultivation, and mainly of interest as curiosities.

vulgàtum, Linn. Adder's Tongue Fern. Fig. 1541. Six–12 in. high, with a spike ¾–1 in. long, bearing a single ovate leaf near the middle of the stem. In low places, Europe and North America.—May be cult. in moist peat in a partially shaded spot. Occasionally found in large numbers in peaty meadows.

L. M. Underwood and F. W. Barclay.

OPHIOPÒGON (Greek, *snake's beard;* a translation of the Japanese name). *Hæmadoràceæ.* Of this genus we cultivate 2 species of hardy, low-growing herbaceous perennials from Japan, with linear foliage, which is often striped or spotted with white or yellow, and racemes of small, 6-parted, pendulous fls., varying from white through lilac to violet-purple. The species mentioned below are not very exciting. They are procurable from a few dealers in hardy perennials, from specialists in Japanese plants and from Dutch bulb-growers. J. B. Keller writes that the most popular form is *O. Jaburan*, var. *aureus variegatus*, which is chiefly used as a greenhouse foliage plant. The fls. of *O. Jaburan* are followed by large, showy, shining dark blue berries. It is easy to manage in the window, and is almost hardy. *O. spicatus* is properly *Liriope spicata.*

The genus is an oriental one of about 7 species of herbs. The plants have a short, thick rhizome, and the fibrous roots sometimes act like runners, and sometimes are thickened into tubers: lvs. linear or oblong-lanceolate and narrowed into a petiole: bracts small, scarious: perianth-tube none; stamens 6, fixed at the base of the segments; filaments erect, distinct, shorter than the linear anthers: cells of ovary 2-ovuled: seeds in the form of a globose berry.

A. *Lower fls. in groups of 2–3.*

Japónicus, Ker. Perennial, stemless, glabrous herb, with a stoloniferous rhizome: fibrous roots long, slender, often nodulose: root-lvs. numerous, erect, narrowly linear, ½–1 ft., 1–1½ lines wide, 5–7-nerved: scape 2–4 in. long: raceme lax, few-fld., 2–3 in. long: fls. drooping, violet-purple to lilac or more or less whitish. Jap., Corea, northern China. B.M. 1063.—Var. **variegàtus**, Hort., has variegated foliage.

AA. *Lower fls. in groups of 6–9.*

Jabùran, Lodd. Habit of the above, but more robust: lvs. 1½–3 ft. long, 4–6 lines wide, many-nerved: scape ½–2 ft. long: raceme 3–6 in. long: fls. white to lilac. Japan. L.B.C. 19:1876 (a fine pure white).—Var. **cœrùleus**, Hort., has "blue" fls. Var. **àureus variegàtus** has foliage striped golden yellow. Var. **argénteus variegàtus** has foliage spotted white. Var. **argénteus vittàtus** has foliage striped with white.

W. M.

Ophiopogons are said to be hardy, but they are not reliably so. *O. Japonicus* lived for three winters in an exposed position on our rock garden, so that we felt inclined to believe it would continue so. One severe winter every plant died. *O. Jaburan* will occasionally live, but its foliage gets badly spoiled, so that we now lift it and store in coldframes. The variegated form, especially the one with blue flowers, is very ornamental. It may be used effectively in a variety of ways. It combines nicely with dwarf foliage plants in the make-up of mixed vases for parlor decoration. It has a permanent value, as after its new growth is made in springtime its variegation does not change nor its growth increase. Its leaves are leathery and durable, and thus it is effective the whole season. Spikes of blue flowers sent up in August add much to its beauty, combining most effectively with the yellow and green variegation. It is increased by divisions of the rhizomatous roots. Any soil and situation will suit it. We have had it do well in peaty soil and also in ordinary loam and shady corners, where scarcely anything else will grow. But, of course, the plants have been put out after their season's growth has been made in coldframes in spring.

T. D. Hatfield.

ÒPHRYS (Greek, *eyebrow*). *Orchidàceæ.* A genus of terrestrial orchids mostly in the north temperate zone in Europe, Asia and N. Africa, the greater number being found in the Mediterranean region. They have the habit of Goodyera, bearing a basal rosette of lvs. with an erect flower-stem terminating in a raceme or spike of fls. Sepals similar, spreading: petals smaller, often pubescent: labellum generally convex with incurved margins, not spurred, entire or 3-lobed: column short. Culture as for Habenaria.

The following are advertised by Dutch bulb dealers:

A. *Margin of the labellum brown or purple-brown.*

B. *Labellum scarcely longer than the sepal.*

C. *Sepals green.*

aranifera, Huds. Spider Orchis. Resembles *O. apifera.* Sepals green; petals very short; labellum dull brown, marked with paler spots, obscurely lobed. Spring and early summer. Europe. B.M. 5712. B.R. 14:1197.

fùsca, Link. Lvs. oblong-lanceolate, those on the stem narrower: sepals green, ovate-oblong, the upper one smaller, oblong; petals half as long, lanceolate-obtuse; labellum oblong, dark purple and hairy on the margin, disk light blue, polished. Mediterranean region. B.R. 13:1071.

CC. *Sepals rose-colored or white.*

arachnites, Lam. Stem erect, leafy: lvs. ovate-lanceolate: fls. distant; sepals ovate concave, rose-colored, tinged with green; petals conical, fleshy, smaller than the sepals and colored like them; labellum round, with the sides reflexed, black-purple, with yellow marks and green appendages. Cent. Europe. B.M. 2516.

apifera, Huds. (*O. arachnites*, Reichard). Bee Orchis. Stem 9–18 in. high, with few oblong or lanceolate lvs.: fls. 3–6, rather large; sepals ovate, pale pink or white; petals smaller, erect; labellum broad, convex, lobes all turned, velvety brown, marked with paler lines or spots. Fls. early summer. Dry pastures, Cent. and S. Europe.

BB. *Labellum longer than the sepals.*

Spéculum, Link. Looking-Glass Orchis. Stem 4–12 in. high, 3–6-fld.: lvs. linear-oblong: fls. ½–1 in. across; sepals linear-oblong, green, with purple bands; petals very small, triangular-lanceolate, dark purple-brown; labellum quadrate, oblong, very convex; disk shining blue, with a yellow edge; margin pilose and fimbriate, maroon-purple. Mediterranean region. B. M. 5841. B.R. 5:370.

muscifera, Huds. (*O. myòdes*, Jacq.). Fly Orchis. Stem very slender, 3–4-fld.: sepals oblong or narrowly ovate, greenish; petals narrowly linear; labellum long, oblong, purplish brown, with pale white or blue marks in the center; central lobe notched. Spring and early summer. Cent. and E. Europe. R.B. 21:241.

AA. *Margin of the labellum yellow or greenish yellow.*

tenthrediniféra, Willd. SAWFLY ORCHIS. Stem 6 in. high: lvs. elliptic-lanceolate: spike 3–8-fld.: fls. nearly 1 in. across; sepals oblong, obtuse, concave, varying from rose to white; petals very small; labellum broadly obcordate, greenish yellow, pubescent, with a large chestnut-colored spot on the disk. Mediterranean region. B.R. 3:205; 13.1093. B.M. 1930. F. 1872, p. 128.

lùtea, Cav. Stem 4–7 in. tall, many-fld.: lvs. linear-oblong: fls. ¾ in. across; sepals oblong, obtuse, incurved, green; petals much smaller, linear-oblong; labellum quadrate, golden yellow, with a purple disk. Mediterranean region. B.M. 5941.

Aceras anthropóphora, Br. Advertised as Ophrys anthropophora, Linn. MAN ORCHIS. Stem about 9 in. high, the spike being 2–4 in. long: lvs. ovate to oblong or lanceolate: fls. dull yellowish green; sepals and petals converging over the column; labellum much longer than the sepals; side lobes long, narrow, and the middle lobe split into two narrow lobes. Early summer. Pastures, S. Europe. Ophrys differs from Aceras in having a very convex labellum. Both genera are distinguished from Orchis by the absence of a spur.

HEINRICH HASSELBRING.

OPLÍSMENUS (Greek, *awned;* referring to the awns). *Gramineæ.* A genus allied to Panicum, containing 4 species of the warmer regions, one of which is cult. in conservatories for ornament. Spikelet 1-fld.; first and second glume, and often the third, awned.

1542. Oplismenus Burmannii.

Búrmannii, Pal. (*Panicum variegatum* of florists). Fig. 1542. A half-creeping perennial, with small, simple panicles, the common form with neatly white and pink striped leaves. Trop. Asia.—Popular for edges of beds and for hanging baskets. Propagated by divisions of the rooting stems. Gn. 47, p. 68. A. S. HITCHCOCK.

OPIUM is the product of *Papaver somniferum*, the common annual summer-blooming poppy of our gardens with smooth, glaucous leaves.

OPOPANAX. See *Acacia.*

OPÚNTIA (old Latin name used by Pliny, later used for the Indian Fig, thought by some to be derived from Opus, a town in Greece: by some authors the name is said to have been derived from a small port, Opus, in South America, from whence plants of the Indian Fig were early exported to the Old World). *Cactàceæ.* Opuntia is a genus of great variation in habit and appearance, and, from the frequency of natural hybrids and ill-defined specific lines, one of the most difficult genera of flowering plants to satisfactorily present in systematic order. Opuntias vary from small, prostrate plants a few inches above the ground to trees with spreading tops 20 or more feet high. The stems are flat, clavate or cylindrical, and bear more or less elevated areolæ, from each of which appears a small caducous pointed leaf, rarely spreading and foliar. An oval or circular area, more or less covered with soft wool, intermixed with barbed bristles and usually a variable number of spines, occurs in the axil of each leaf. The flowers are borne singly toward the upper portion of the joints or stems, on the bristle-bearing part of the areola, and have spreading, showy corollas. The usually many-ovuled inferior ovaries are not of foliar development, and sometimes differ but slightly in appearance from normal stems. They are usually bristle- and spine-bearing. Fr. dry or succulent, frequently edible; seeds large, flattened, discoid and often margined. Some of the forms of Opuntias are seen in the illustrations (Figs. 1543–1549).

Some of the largest Cacti are Opuntias, while nearly all that are of economic value belong to this genus. The genus numbers about 130 species and many varieties and hybrids. It extends from British America southward through the United States, Mexico, West Indies and Central America to the southern portion of South America. The species are confined mostly to arid and semi-arid regions; however, some are found in regions of heavy rainfall. They are found in greatest quantity and variety of species in southwestern United States and northern Mexico, where they are often trees and form the most conspicuous part of the flora. A few species are extensively cultivated in warm regions for their large, edible fruits, while others are grown as hedges. Where introduced, many species have escaped from cultivation and become dangerous and troublesome weeds. Although the Opuntias are less attractive as pot-plants and, on account of their barbed spines and bristles, more difficult to handle than most other Cacti, they are coming into favor on account of their unique appearance, rapidity of growth and attractive fls. They grow best with an abundance of heat and sunlight, the character of the soil being a secondary consideration. Like all other Cacti, they require perfect drainage. They are readily grown from cuttings, and also from seed under proper management.

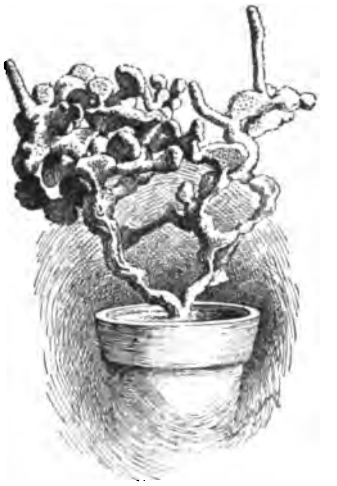
Economic Value.—Economically considered, the Opuntias are by far the most important of the Cacti. Although originally confined to the New World, the more important species are now in cultivation or have escaped from cultivation and become wild in every arid and semi-arid region of the globe where the temperature permits their being grown. Wherever grown, their tendency is to escape from cultivation and become persistent and troublesome weeds. In this respect they are much more to be dreaded in foreign countries than in America, the place of their nativity.

Ornamental Value.—As ornamental plants, Opuntias are unique rather than pleasing. From their stiff, formal aspect they do not harmonize, as a rule, with other plants, and on account of their spines and bristles they are difficult to handle and are considered by most gardeners as a nuisance in decorative planting. It is as hedges and as groups of mixed species that they are most effective.

Most species grow rapidly and bloom profusely. The fls., as a rule, are large and showy and of various colors, although yellow predominates. They soon wither after blooming and remain at their best only for a few days. The spines and bristles which usually cover the base of the fls. render them of no value as cut-flowers. With many species, such as *O. leptocaulis*, *O. tetracantha*, and some forms of *O. Tuna*, the bright-colored fruits, which remain on the plants for a long time after ripening, render them more attractive in fruit than in flower. Crested or fasciate forms (Fig. 1543) are common.

The Fruit of the Opuntias.—Although extensively cultivated for their fruit in many countries, where they furnish an important article of diet for 4–5 months each year, they do not as yet take a pomological rank with the horticulturist, though they are much more widely used and of far more economic importance than many plants which have an established place in pomological literature. From the fact that Opuntias flourish best in regions where experimental horticulture receives little or no attention, the development of desirable economic varieties has not been what might be expected of plants which respond so readily to cultivation and selection, and which may be hybridized with so little difficulty.

Botanically considered, the fruit is a kind of berry, varying from dry to fleshy and succulent. Morphologically, it is a modified stem with the true seed capsule sunken into its apex; hence it bears leaves and spines, and usually under suitable conditions and frequently in the natural state, when it becomes detached, will bud and grow like a normal stem-cutting.



1543. Opuntia ramosissima.
To illustrate fasciation, which is of frequent occurrence in nearly all species of Cacti.

History.—Opuntias were cult. by the aborigines of America at the time of its discovery, and were early taken by the Spanish explorers to Spain and Spanish colonies in other parts of the world. After becoming established in the Canaries, Azores, and Madeira islands, it was not long before their culture extended to Portugal, Spain and the whole littoral region of the Mediterranean. From there they spread to Egypt, India, and other parts of southern Asia. In comparatively later times they reached South Africa, Australia, and New South Wales, where they are fast becoming a serious menace to agriculture and grazing. In all the regions above noted they have escaped from cultivation and have become pestiferous weeds.

Varieties in Cultivation.—The want of fixed characters, the great variations in most species under different soil and climatic conditions, and the readiness with which natural hybrids occur, make the identification of cultivated and introduced species so difficult that the considerable literature on this subject is extremely uncertain as to nomenclature. The common names Indian Fig, Barberry Fig, Prickly Pear, and Tuna, are applied indiscriminately by most people to any flat-jointed Opuntias, but more particularly to the kinds with edible fruits.

The two most widely distributed and extensively cultivated are *O. Ficus-Indica* and *O. Tuna*. These plants have often been confused by authors. Much that has been written under the name of one species really applies to the other. They are closely linked together by hybrids, and each has been in cultivation for so long a period that numerous cultural varieties have developed, particularly in Mexico and Sicily. It is possible that the many cultivated forms of both species originated from the same source.

Although the Mexicans and Indians eat the fruit of more than a score of indigenous species, the two named above, with their many cultivated forms, are by far the most desirable and palatable. *O. Ficus-Indica* is preferable in most respects to *O. Tuna* on account of its fewer and smaller spines and usually larger fruit. The latter, however, makes a more formidable hedge, and is more frequently planted in the United States. Hedges of this plant are to be seen at many of the old Spanish missions in Arizona and California, where they were probably first introduced into the United States. *O. Ficus-Indica* is frequently grown by the Mexican population of New Mexico, Arizona and California. In southern Florida it has escaped from cultivation and become naturalized. The fruits are usually larger and fewer-seeded than in *O. Tuna*, and are commonly yellow. They frequently measure 3 or 4 in. in length and 2–3 in. in width. Forms of this species about the old missions of southern California vary considerably. One form, known as *Tuna Colorado*, has an insipid, light crimson-colored fruit, while another, *Tuna manse*, has a yellowish fruit, irregularly mottled with crimson.

The Fruit Economically Considered.—These two Opuntias, and possibly a few other closely allied ones, are extensively grown in Mexico. The fruit begins to ripen in June and July, while the later varieties last until December. The fruit is consumed by all classes and conditions of people. The fine bristles which invest the fruit are usually removed before picking by rubbing them with straw, grass or leaves. The fruit is later picked by the hand, or, in some instances, with wooden tongs. In large plantations, when the fruit is raised for commercial purposes, it is usually harvested with a heavy knife, the workman first cutting off the joint bearing the fruit, and later detaching the separate fruits.

In preparing the fruit for the table, a thin slice is cut from each end and a slit made through the paring, joining the cut surfaces. The thin paring is easily separated from the mealy but juicy pulp, and quickly removed with the fingers.

To-day the finest Opuntia fruits are grown in Sicily, where they are one of the most important crops that the island produces. From July to November the peasants live almost entirely on this fruit, and considerable quantities are yearly exported to other countries, some of which finds its way to New York and other American cities. It is grown extensively by the Arabs throughout northern Africa, and forms an important part of their food for a portion of each year.

Nutritive Value of the Fruit.—The nutritive value of this fruit ranks high, as shown by the following analysis by Wolff:

	Per cent
Dry substance	21.60
Ligneous matter	3.70
Proteid substances	.59
Fatty bodies	1.80
Sugar	14.

Yield per Acre.—It has been ascertained that some of the best varieties are capable of producing on lean, sandy or rocky soil, ill-suited for growing ordinary crops, as much as 18,000 lbs. of fruit per acre. When we consider that this is equal to 2,500 lbs. of sugar, as well as other valuable food constituents, it may be readily seen that the food value from the standpoint of nutrition is considerable.

Method of Culture.—Plantations are usually made on dry slopes of hills, as the plants do not thrive where there is much moisture or on heavy clay soils. Joints, cut or broken from the plants, are used instead of seeds, and are planted at distances of 6 to 8 ft. in furrows from 6 to 15 ft. apart. No tillage is practiced, as they grow rapidly, and in a few years shade and smother out all other growth. Before planting, the cuttings are exposed in half sunlight from seven to fifteen days, that they may partially wither, in order to facilitate rooting.

An important advantage in the culture of these plants is the regularity of the yearly crop. They begin to bear in about three years after planting, and continue in bearing for many years.

Of the Opuntias indigenous to the United States, none as yet have been grown for fruit, or with an effort to improve them. *O. Engelmannii* has a large but poorly-flavored fruit, rarely eaten even by the Indians. *O. lævis* has one of the largest and most palatable fruits of any of the species found growing wild within the United States. This plant also has the advantage of having but few spines. *O. Camanchica*, *O. Rafinesquii*, *O. chlorotica*, *O. phæacantha* and *O. macrocentra* have medium-sized fruits, insipid and unpalatable to the cultivated taste, but eaten by Indians and Mexicans.

Wherever grown extensively, the Opuntia fruits are used for making a weak alcoholic drink. The juices of the highly colored sorts are sometimes used to color confectionery.

Opuntias as Forage.—Many of the Opuntias have considerable forage value, particularly during periods of long drought when other forage crops are short. The range cattle of the southwestern United States feed on either the branches or fruits, or both, of nearly all the indigenous species, the flat stems of *O. Engelmannii* and the pendulous fruit clusters of *O. fulgida* being most largely consumed. When cattle feed largely upon spiny Opuntias the spines and bristles often collect in their stomachs, forming large phyto-bezoars. During years of scarcity of other forage, thousands of cattle die in Texas, New Mexico and Arizona, where the cause assigned is starvation, when in reality the direct cause of death has been the perforation of the alimentary canal by the numerous spines of Opuntias.

In northern Africa the flat joints of the forms with few spines are used as forage for cattle during the dry season, after being allowed to ferment slightly. In Tunis, plantations are sustained by dairymen for the purpose of feeding their cows upon the fleshy stems.

O. Tuna has run wild to a remarkable extent in southern Africa. It has spread rapidly during the past century, and in many places has crowded out the grasses and become a nuisance. Two forms of the plant are recognized by the Dutch farmers; viz., a thorny variety growing on the open country and on stony hillsides known as Doornblad, and a fewer-spined larger variety with thicker stems known as Kaalblad. It is probable that these two varieties originated from the same introduction, for, according to Mr. Macdonald, the seed from the Doornblad or Kaalblad variety may give rise to plants resembling either or both of them. It is extensively used as feed for cattle, ostriches and pigs, either alone or when mixed with other forage. Here, however, much harm has come from range cattle eating it in times of little or no other forage, and ostriches become blind from the spines and bristles getting into their eyes in eating the fruits.

In New South Wales and Australia, where several species have escaped from cultivation and spread over large areas of arable land and driven out more valuable forage plants, the land has depreciated 50 per cent in value. Here, however, some of the worthless species, such as *O. vulgaris* and *O. monacantha*, are more widely spread than the more valuable varieties of *O. Ficus-Indica* and *O. Tuna*.

Possible Improvement of Present Varieties.—From what has been said it may be seen, first, that varieties of *O. Ficus-Indica* and *O. Tuna* produce large crops of edible and nutritious fruits; second, that plants with few or no spines are the general rule in *O. Ficus-Indica* and of not infrequent occurrence in *O. Tuna;* third, that Opuntias are strong, vigorous plants that will grow in situations in which few other plants will thrive; fourth, that spineless forms make valuable forage.

With these and more qualities to recommend them, it yet remains for horticultural enterprise to develop a spineless and bristleless variety that will not only be of value for forage but will produce large crops of fruits as attractive to the educated palate as to the savage. From the experience gained in establishing a garden of nearly 70 species and varieties of Opuntias, comprising about 300 plants, and watching their growth and behavior for several years, the writer believes that they offer great possibilities in the way of improvement in the hands of a careful plant-breeder. J. W. TOUMEY.

Hardy Opuntias satisfy a rather general desire for something unique or grotesque, while at the same time they possess enough ornamental value to recommend them to everyone, and especially to those lovers of cactaceous and succulent plants whose space indoors is limited. Being natives of the western plains and foothills of the mountains, they can scarcely suffer from long-continued drought, and the sunny side of the rockery will suit them exactly, as it will allow all surplus moisture to drain off, and no artificial watering will be necessary. Mr. William Falconer, who has used large quantities at Schenley Park, Pittsburgh, Pa., writes as follows: "In certain localities, as on bleak, exposed banks and about rocky knolls, Opuntias and *Yucca angustifolia* can be used unsparingly with perfect success." He also says, "All have been planted out-of-doors, remaining unprotected summer and winter, and all have been perfectly hardy." They have succeeded also at Kew Gardens, in the very humid climate of England, without protection. Their requirements seem to be as follows: a porous, well-drained soil, a sunny exposure, and a season long enough in which to ripen the fruit and annual growth; these conditions being complied with, they will endure almost any degree of cold to be experienced even in the most northern portions of the U. S. Their altitude-limit in Colorado indicates that they will succeed as far north as Indian corn can be matured. The following kinds have been used successfully, as above indicated: *O. arenaria*, with small, round to oblong, very spiny joints, the spines varying much in color from gray and straw color to purplish brown. *O. arborescens*, the Tree or Candelabrum Cactus, the tallest of this list, is of cylindrical branching growth, with bright purple flowers and yellow fruit. *O. Camanchica* has very large, orbicular joints, the upper half thickly beset with spines, fruit purple. *O. fragilis* resembles *O. arenaria*, but is smaller. *O. mesacantha* includes a multitude of forms, all of which are very hardy. *O. phæacantha*, var. *major*, is one of the most striking sorts, with immense, glaucous joints, dark purple spines, yellow flowers, and purple fruit. *O. polycantha* is one of the most variable, as well as one of the most showy. The spines vary from ivory white to purple and brown, and from short and stout to long and slender. Nearly all the Opuntias have very showy flowers, usually in various shades of yellow and orange.

D. M. ANDREWS.

In the following synopsis it has not been possible in all instances to group the species so as to show relationships. A purely artificial key has not been attempted, as the species at best are separated by a great variety of characters. It will be seen that the list runs to 61 species, or practically half of all the known kinds. It will be noted, also, that a large part of the species in the trade are from Mexico and other southern regions. The Cochineal plant, often referred to Opuntia, must be sought under Nopalea. For the relationship of Opuntias to other cactaceous plants, and for additional hints on culture, see the article *Cactus* in Vol. I.

INDEX.

acanthocarpa, 46.
albispina, 14, 29.
arborescens, 54.
arbuscula, 59.
arenaria, 31.
aurantiaca, 4.
basilaris, 7.
Bernardina, 48.
Bigelowii, 52.
brachyarthra, 32.
Brasiliensis, 1.
Camanchica, 20.
candelabriformis, 11.
chlorotica, 16.
clavarioides, 35.
clavata, 40.
coccinellifera, 61.
crassa, 12.
crinifera, 5.
cylindrica, 33.
cymochila, 24.
Darwinii, 37.
Davisii, 45.
diademata, 38.
echinocarpa, 47.
Emoryi, 43.
Engelmannii, 18.
ferox, 29.
Ficus-Indica, 13.
filipendula, 23.
fragilis, 32.
frutescens, 60.
fulgida, 51.
fulvispina, 9.
Galapageia, 2.
glauca, 12.
Grahamii, 41.
gigantea, 20.
Greenii, 24.
Grizzly-bear, 27.
horrida, 15.
hystricina, 28.
imbricata, 53.
invicta, 44.
leptocaulis, 60.
leucotricha, 9.
macrocentra, 21.
macrorhiza, 24.
mamillata, 51.
mesacantha, 24.
microdasys, 6.
microsperma, 29.
Missouriensis, 29.
monacantha, 3.
nigricans, 22.
oplocarpa, 24.
papyracantha, 38.
Pes-corvi, 26.
phæacantha, 19.
platycarpa, 29.
polyantha, 14.
prolifera, 50.
puberula, 8.
pulchella, 39.
pycnacantha, 17.
Rafinesquii, 24.
ramosa, 7.
ramosissima, 61.
rufida, 6.
rufispina, 29.
rutila, 30.
Salmiana, 36.
Schottii, 42.
senilis, 5.
serpentina, 49.
spinosior, 55.
splendens, 29.
stellata, 54.
stenochila, 24.
tessellata, 61.
tetracantha, 58.
Treleasii, 7.
triacantha, 10.
tricophora, 29.
Tuna, 15.
ursina, 27.
variegata, 3.
versicolor, 57.
vulgaris, 25.
vestita, 34.
Whipplei, 56.

A. *Articulations or joints strikingly different, flat to cylindrical*................ 1. **Brasiliensis**

AA. *Articulations or joints similar, more or less flattened.*

B. *Species from S. America*... 2. **Galapageia**
3. **monacantha**
4. **aurantiaca**
5. **crinifera**

BB. *Species from N. America.*

C. *Joints pubescent*.......... 6. **microdasys**
7. **basilaris**
8. **puberula**

CC. *Joints not pubescent (except sometimes in O. pycnacantha).*

D. *Fruit fleshy or succulent.*

E. *Size of joints large: plants mostly large (O. crassa moderately small).*

F. *Color of spines white*....... 9. **leucotricha**
10. **triacantha**
11. **candelabriformis**

FF. *Color of spines yellow (sometimes red to white in O. Engelmannii, polyantha, crassa, and Ficus-Indica.)*

G. *Spines none or few*.........12. **crassa**
13. **Ficus-Indica**

GG. *Spines always present, few to many. (One form of O. macrocentra has no spines, and occasional plants of O. chlorotica are without spines.)*..........14. **polyantha**
15. **Tuna**
16. **chlorotica**
17. **pycnacantha**
18. **Engelmannii**

FFF. *Color of spines reddish brown to black, usually with purplish joints*......19. **phæacantha**
20. **Camanchica**
21. **macrocentra**
22. **nigricans**

EE. *Size of joints small: joints variable in shape: plants mostly low or prostrate. (Some forms of O. Rafinesquii have moderately large joints.)*............23. **filipendula**
24. **Rafinesquii**
25. **vulgaris**
26. **Pes-corvi**

DD. *Fruit dry, more or less spiny*....................27. **ursina**
28. **hystricina**
29. **Missouriensis**
30. **rutila**
31. **arenaria**
32. **fragilis**

AAA. *Articulations or joints similar, more or less cylindrical.*

B. *Species from S. America.*

C. *Joints cylindrical, mostly elongated*................33. **cylindrica**
34. **vestita**
35. **clavarioides**
36. **Salmiana**

CC. *Joints globose to broadly obovate*..................37. **Darwinii**
38. **diademata**

BB. *Species from N. America.*

C. *Spines without sheaths: plants mostly small, with clavate joints*.............39. **pulchella**
40. **clavata**
41. **Grahamii**
42. **Schottii**
43. **Emoryi**
44. **invicta**

CC. *Spines sheathed: joints cylindrical or nearly so, more or less elongated.*

D. *Number of spines variable, always more than one.*

E. *Fruit dry, usually spiny*...45. **Davisii**
46. **acanthocarpa**
47. **echinocarpa**
48. **Bernardina**
49. **serpentina**

EE. *Fruit fleshy, proliferous*....50. **prolifera**
51. **fulgida**

EEE. *Fruit fleshy, rarely proliferous*.....................52. **Bigelovii**
53. **imbricata**
54. **arborescens**
55. **spinosior**
56. **Whipplei**
57. **versicolor**
58. **tetracantha**

DD. *Number of spines few, usually one, rarely more or wanting*..................59. **arbuscula**
60. **leptocaulis**
61. **ramosissima**

1. **Brasiliénsis**, Haw. A large, tree-like plant reaching a height of 15–18 ft., numerously branched, with a thick, roundish crown and an upright trunk, 4–6 in. in diam., and bearing numerous spines 1 in. or less in length: joints of two kinds, cylindrical, unarticulate, elongate ones and others which are shorter and much flattened and which arise as offshoots from the former; the latter leaf-like, thin, 2–6 in. long, oblong, rarely oblong-lanceolate or orbicular, dark green, margin angular, sometimes irregular: areolæ with short, gray wool and numerous brown bristles; spines usually 1, sometimes 1–3 small additional ones, 1–2⅛ in. long, mostly from the marginal areolæ, white, with brownish tips: fls. numerous, citron-yellow, 2 in. wide: fr. globose or ellipsoidal, yellow, about 1⅛ in. in diam. Brazil and southward.—One of the species most frequent in cult.

2. **Galapagèia**, Hemsl. An upright, tree-like plant 6–10 ft. high, with a circular, spreading crown and a very spiny trunk, 6–8 in. in diam., and light-colored bark becoming loosened and hanging in fragments from the older stems: joints elliptical to oblong, thick, 10–14 in. long: spines at first 3–4, spreading, flexible, increasing in number and size with age, finally covering the joints with long, brush-like bundles: fls. small, less than 1 in. wide, red: fr. subglobose, red. Galapagos Islands.

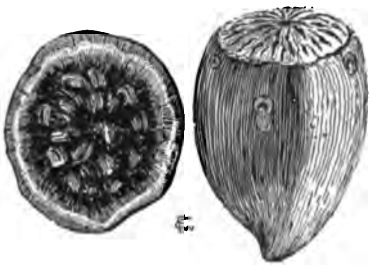
3. **monacántha**, Haw. An upright plant branching from the ground and reaching a height of 6 or more feet: joints oblong to elliptical, rather thick, terminal ones much thinner, 5–12 in. long, 3–6 in. wide, bright green: areolæ with uniformly short wool and yellowish brown bristles; spines 1–2, seldom more, erect, ¼–1⅛ in. long, yellow to dark reddish brown: fls. yellow, 3 in. wide: fr. ellipsoidal to pyriform, occasionally proliferous, red, somewhat spiny. Argentine Republic.—The horticultural variety **variegàta** is in the trade.

4. **aurantiaca**, Gill. A numerously branched, rather weak, semi-prostrate plant 3–5 ft. high: joints linear-lanceolate to lanceolate, 2–10 in. long, ½–1 in. wide, elliptical in transverse section, dark green, turgid: areolæ with a tuft of grayish white wool and bright yellow bristles; spines 4–6, spreading, straight, stiff, brown to yellow, the longest less than 1 in. in length: fls. yellow, 1½–2 in. wide: fr. carmine-red, globose, with short spines; seed with woolly hairs. Argentine Republic.

5. **crinifera**. Pfeiff. (*O. senilis*, Parm.). A much-branched, wide-spreading plant, about 3 ft. high: joints obovate to elliptical, 6 in. long and 3–4 in. wide, dark green, occasionally glossy: areolæ crowded, small, with white wool, numerous golden yellow bristles, and a variable number of long silky hairs: spines 6–8, later more, white, glistening, reaching 1 in. in length, the long silky hairs particularly developed on the under side of the young joints: fls. 3½–4 in. wide, golden yellow, often reddish. Brazil(?).

6. **microdàsys**, Lehm. An erect, wide-spreading plant, rarely exceeding 3 ft. in height: joints elliptical to obovate, 3–4 in. long and nearly as wide, thick, bright green, densely pubescent: areolæ with short, whitish wool and numerous golden yellow bristles of variable lengths; spines wanting: fls. greenish to lemon-yellow, about 2 in. wide: fr. comparatively small, oval, less than 1 in. in diam., armed with numerous yellow bristles: flesh whitish. Northern Mexico southward.

Var. **rùfida**, K. Sch. Of more robust growth: joints rounder and larger, paler green, the bristles inclined to reddish brown. Mex.



1544. **Fruit of Opuntia Ficus-Indica** (× ½). No. 13.

7. **basilàris**, Engelm. and Begel. A low, spreading plant, rarely 1 ft. high: joints thick, variable, usually broadly obovate, with more or less truncate top and branching from the base, 4–7 in. long and 2–4 in. wide, bluish green, and very minutely pubescent: areolæ depressed, close together, and with brownish yellow wool and numerous short, yellowish brown bristles; spines wanting, rarely present: fls. dark purple, rarely white, 3 in. or more in diam.: fr. short, thick, green, becoming white and dry at maturity and filled with many large white seeds. Southwest U. S. and northern Mex.

Var. **ramòsa**, Parish. A smaller plant, with joints branching from the upper end, and usually glabrous. S. Calif.

Var. **Trelèasii**, Coult. Differs from the species in having larger orbicular or obovate joints, with terete base, and larger leaves. S. Calif.

8. **pubérula**, Pfeiff. A numerously branched and upright plant, 2–3 ft. high: joints obovate or somewhat rounder, when young covered with very soft pubescence which becomes bright green with age: areolæ with short, brownish yellow wool and numerous short, amber-colored bristles; spines 5–7, 1 in. or more in length, straight, cylindrical, white, with amber-colored base, shining, the lower ones the longer: fls. 1½–2 in. wide, greenish yellow: fr. oval, 1½ in. in diam., the many areolæ bearing short wool and many bright amber-colored bristles; flesh sweetish; seeds many, correspondingly small. Mex.

9. **leucótricha**, P. DC. (*O. fulvispina*, Salm.). An upright, numerously branched plant, sometimes reaching the height of 10 ft.: joints elliptical or narrower, mostly rounded at the end, 8–10 in. long and half as wide, dark green: areolæ small, with white or whitish gray wool and numerous short brown bristles; spines very slender, mostly 4 at first, but later as many as 10–12; some reach the length of 3–4 in., becoming bristle-like and very flexible: fls. 2–3 in. wide, yellow, with reddish center: fr. spherical, 1–1¼ in. in diam., pale green to white, thickly beset with velvety wool and brownish yellow bristles; pulp sweet, edible. Mex.

10. **triacántha**, P. DC. An upright, tree-like plant, reaching 10–12 ft. in height: joints often very large, occasionally 18 in. long and 10 in. wide, obovate, thick, grayish green: areolæ remote, from 1¼–1½ in. apart, with short, grayish wool and yellow bristles; spines 3–4, white, with yellow points and bases, an in. or less long: fls. 2½–3 in. wide, carmine to orange-yellow: fr. elliptical, 1½–2 in. long; pulp acid. West Indies.

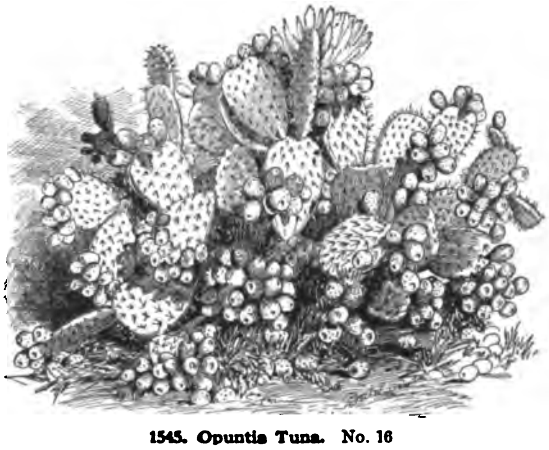
11. **candelabrifórmis**, Mart. An upright, sparingly branched plant, 2–4 ft. high: joints elliptical to obovate, thick, dark green, 6–10 in. long and half as wide: areolæ with brownish white wool, later becoming gray, and numerous white bristles; spines 4–5, of which 3 are very strong, white, 1¼ in. or less in length: fls. 2½–3 in. wide, carmine-red: fr. spiny. Mex.

12. **crássa**, Haw. (*O. glaùca*, Hort.). A sparingly branched, upright plant, 4–6 ft. high: joints oblong to ovate, 3½–5 in. long and two-thirds as wide, glaucous, greenish blue, thick: areolæ with brownish wool, and few bristles of same color; spines usually wanting, sometimes 1–2 an inch or less long, straight and needle-like. Mex.

13. **Ficus-Índica**, Mill. Indian Fig. Fig. 1544. An erect, tree-like plant, reaching the height of 10–15 ft., and with a woody cylindrical trunk: joints elliptical or oblong, often with bluish bloom, thick, often 18 in. long and one-third as wide: areolæ orbicular and sparingly covered with white wool and yellow bristles; spines usually wanting, occasionally 1–2 small, weak ones are present: fls. yellow, expanding to 3–4 in. in diam.: fr. yellow, with reddish pulp, bristly, 2 in. in diam., edible. Mex. —A species widely grown throughout the warm temperate regions of the world. In some regions, escaping from cultivation, it has become a troublesome weed. Frequently cultivated for its fruit under the name of Indian Fig.

14. **polyántha**, Haw. A much-branched, spreading plant, 3 ft. or less in height: joints oblong to obovate, dark green, weak-spined, 4–6 in. long and 3–4 in. wide: areolæ with white wool and brown bristles; spines 3–8, slender, golden yellow, seldom over ¾ in. long: fls. 2½ in. wide: fr. broadly oval, deep red. West Indies (?). For var. **albispina** consult **O. Missouriensis**, No. 29, of which it is perhaps a form.

15. **Tùna**, Mill. (*O. hórrida*, Salm.). Figs. 1545, 1546. An erect, wide-spreading, tree-like plant, rapid-growing and frequently 10–12 ft. high: joints deep green, mostly elliptical, 10–14 in. long and 6–10 in. wide: areolæ with whitish wool which later becomes dirty gray, and a fascicle of long brownish yellow bristles; spines 4–6, rigid, stout, yellow, frequently subulate, spreading, unequal in length, 1–2 in. long: fls. 3–4 in. wide, yellow, fading to red: fr. pear-shaped or rounder, 1–1½ in. in diam., sweet, edible, dark reddish purple. West Indies and Mexico.—Probably the most extensively cultivated of all the Opuntias. Under the name of "Tuna" it has been grown in southwestern United States, West Indies and Mexico since the earliest Spanish possession. It is extensively grown both for its fruit and as a hedge plant. It has escaped from cultivation and become naturalized in North and South Africa, southern Europe, southwestern Asia and Australia, and in some places has become a troublesome weed.



1545. **Opuntia Tuna.** No. 16

16. **chlorótica**, Engelm. A compact, upright, moderately branched plant, from 3–6 ft. high, the trunk and main stems becoming woody and terete, and densely covered with long straw-colored bristles and spines: joints orbicular, somewhat glaucous, 6–10 in. in diam.: areolæ

crowded, with fine, gray wool and very numerous golden yellow bristles of unequal length; spines 3–6, rarely none, on old stems occasionally 40 or more, unequal, angular, golden yellow, deflexed, usually 1 in. or less long: fls. yellow, 2–3 in. in diam: fr. deep purple, moderately bristly, edible, 1½ in in diam., broadly obovate to globose; seeds comparatively small, sometimes sterile. Southwest U. S.

1546. Hedge of Opuntia Tuna. No. 15.

17. **pycnacántha**, Engelm. An upright, moderately branched plant, 3–5 ft. high: joints oval to orbicular, occasionally somewhat pointed at the ends, 4–8 in. long, sometimes pubescent, armed with a densely interwoven covering of mostly deflexed spines: areolæ crowded, approximately ⅛ in. apart, with dark brown wool and numerous long, yellow bristles; spines 3–7, on old stems 20 or more, straw-colored to ashy, mostly less than 1 in. long: fls. greenish yellow, 2–3 in. broad: fr. obovate, 1½ in. in diam. and covered with numerous spines and bristles. Lower Calif.

18. **Éngelmannii**, Salm. Fig. 1547. An erect to semi-prostrate, profusely branching, coarse plant, 2–5 ft. high, forming large, impenetrable thickets, usually with a short, more or less terete, woody trunk, with grayish bark which becomes unarmed with age: joints broadly obovate to orbicular, pale to bluish green, very variable in size, in large specimens 12–14 in. long and nearly as wide, moderately thick: areolæ remote, about 1 in. apart, with gray wool and large, rigid, gray to yellow, unequal bristles; spines mostly 2–4, sometimes 1–3 small additional ones, very variable, horny, variously colored, mostly yellow, or white with reddish base, usually compressed or angular and curved or twisted: fls. yellow, red within, fading to red, 2½–3 in. in diam.: fr. broadly pyriform to globose, frequently 2 in. in diam., dark purple, with insipid purple flesh. U. S. and Mex.—This species, with its numerous varieties, is the most widely distributed and abundant of the large, flat-stemmed Opuntias in the United States. It varies greatly in different localities, and its many forms have not as yet been adequately defined.

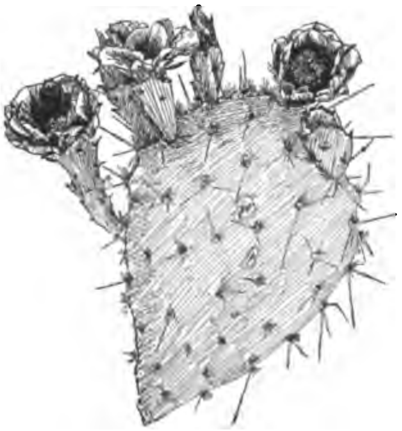
19. **phæacántha**, Engelm. A diffuse, semi-prostrate plant, 1–2 ft. high, and freely rooting from lower margin of joints: joints broadly obovate, moderately thick, 4–6 in. long: areolæ about 1 in. apart, with short wool and reddish or brownish bristles; spines mostly toward margin or on apex of joints, 2–5, straight and stiff, reddish brown to almost black with lighter tips, 1–2½ in. long: fls. 2½ in. broad, yellow: fr. usually long-pyriform, 1 in. or less in diam. and twice as long, purple, with greenish acid pulp. Southwest U. S. and Mex.—This species and a number of the following become deep purplish green during autumn and winter. In the spring they lose their purplish color to a large extent and take it on again in the fall. The spines are also much darker in winter than in summer.

20. **Camánchica**, Engelm. and Begel. A prostrate, widely spreading plant 1–2½ ft. high, and freely rooting at the lower margin of the joints: joints broadly obovate to orbicular, 4–6 in. long, moderately thick: areolæ about 1 in. apart, with light brown, short wool and yellowish brown bristles, mostly armed; spines very variable, usually 1–3, sometimes 3–6, on marginal areolæ, reddish to blackish brown with lighter tips, variable in length, sometimes 2½ in. long: fls. 2½–3 in. wide, yellow, with reddish center: fr. oval to globose, sometimes pyriform, deep red, sweet, edible, 1–1½ in. in diam. Southwest U. S.—Var. **gigantèa** of the trade proves to be *O. phæacantha*.

21. **macrocéntra**, Engelm. A semi-prostrate, spreading plant, 2–3 ft. high: joints strikingly purple-green, very thin, broadly obovate to nearly orbicular, 5–9 in. in diam., with a few remarkably long spines on the marginal areolæ: areolæ about 1 in. apart, with grayish wool and short, grayish yellow bristles; spines rarely wanting, usually 1–2, reddish brown to almost black, annulate 3–5 in. long, slender and straight or variously twisted, sometimes 1–3 much smaller, lighter colored, secondary spines: fls. 3 in. wide, yellow: fr. oval to globose, rarely ovate, 1 in. in diam., red; pulp sweet, edible. Southwestern U. S., Mex.—This species is remarkable for its exceedingly long, dark spines and purple joints.

22. **nigricans**, Haw. A large, robust, upright plant, 2–5 ft. high: joints usually obovate, dark green, rarely tinged with purple, about 10 in. long and 6 in. wide, moderately thick: areolæ with short, grayish wool and yellowish brown bristles; spines 1–2, awl-shaped, 1–2 in. long, strong, dark brown, at first yellowish: fls. 1½–2 in. wide, yellow with red center. Mex.—Frequent in cultivation.

23. **filipéndula**, Engelm. A small, semi-prostrate plant, freely branching from the base of the joints, rarely 10 in. high and with thick, tuberous, moniliform roots: joints small and thin, bluish, glaucous, rarely 3 in. in greatest diam., orbicular to broadly obovate, sometimes diamond-shaped, frequently flattened at the top and broader than long: areolæ orbicular and with an abundance of whitish wool and many long, slender, yellowish green bristles, which are very conspicuous, particularly on the older joints; spines sometimes wanting, when present usually 1–3, rarely more, white, very slender and flexible, 1–2 in. long, mostly marginal: fls. yellow, 1½–2 in. in diam.: fr. clavate to narrowly obovate, 1½ in. long and half as wide, greenish yellow, with few seeds. Texas to Ariz., extending into Mexico.


1547. Opuntia Engelmannii (×⅛). No. 18.

24. **Rafinésquii**, Engelm. (*O. mesacántha*, Rafin.). A wide-spreading, prostrate plant, freely rooting from the lower margin of the joints, roots sometimes tuberous: joints obovate to orbicular, usually 2–5 in. long and 2–4

in. wide, sometimes twice as large, dark to light green: areolæ with gray wool and bright reddish brown bristles; spines sometimes wanting, when present 1–3 and mostly marginal, stout, 1 in. long, white with darker tips and bases, frequently 1–3 small secondary spines also present: fls. 3 in. or less in diam., golden yellow, frequently with reddish center: fr. slender-clavate or broader, 1½–2 in. long, yellowish red to purple, with insipid purplish pulp; seeds comparatively large. West central U. S.—An exceedingly variable species of wide distribution and imperfectly known. Many varieties have been described, some of which are in the trade. The extreme forms vary greatly from the type. Of these forms vars. **Greènii, oplocárpa, cymochila, stenochila** and **macrorhiza** have appeared in the trade. Hardy in Mass.

25. **vulgàris,** Mill. BARBERRY FIG. A diffuse, prostrate plant a foot or less high: joints usually resting on the ground and rooting from the lower margin, obovate to suborbicular, thick, 2–4 in. in greatest diam., pale green: areolæ with grayish wool and a few short, greenish yellow bristles; spines rarely present, when present usually 1, stout, erect, less than 1 in. long, yellow, often variegated: fls. 2 in. wide, pale or chrome-yellow: fr. obovate to spherical, 1 in. in diam., red, flesh insipid. Eastern U. S. Hardy in Mass.

26. **Pes-córvi,** LeConte. A small, diffuse, prostrate plant, rarely reaching 1 ft. in height: joints fragile, somewhat tumid, narrowly ovate to obovate or oblong, 2–4 in. long and less than half as wide, frequently much smaller, very thick, broadly oval in transverse section, bright green with a bluish tinge: areolæ circular, with short, whitish wool and a few short, slender, pale bristles; spines rarely exceeding 2, frequently none, slender, white, often brownish, less than 1 in. long: fls. yellow, 1½ in. wide: fr. obovate, bristly, purplish, 1 in. or less in diam; seeds comparatively large, very few. Florida.

27. **ursina,** Web. (*Grizzly-bear Opuntia*). Fig. 1548. An upright, diffuse plant, 1–2 ft. high: joints oblong to obovate, grayish green, thick, 3–6 in. long and 2–4 in. wide: ariolæ with white wool and numerous yellow bristles; spines 12–20, reddish white, very slender and bristle-like, sometimes 4 in. long, frequently almost completely hiding the epidermis of the plant: fls. 2½–3 in. wide, reddish yellow. Calif.—Popularly known as "Grizzly Bear" Cactus.

28. **hystricina,** Engelm and Bigel. A semi-prostrate, spreading plant, ½–1½ ft. high: joints obovate to orbicular, 3–5 in. long, moderately thick and very spiny: areolæ with grayish wool and yellowish red bristles; spines 10–15, 2 in. long or shorter, white or dusky, slender, flexile, angular and twisted: fls. light purple, 2–3 in. wide: fr. broadly obovate, 1 in. in diam., armed with many long spines. Southwest U. S.

29. **Missouriénsis,** P. DC. (*O. fèrox*, Haw. *O. splèndens*, Hort.). A prostrate, wide-spreading plant, rarely rising 1 ft. above the ground: joints variable, from elongate-obovate to orbicular, usually bright green, frequently wrinkled and tuberculate, 2–6 in. long: areolæ about ½ in. apart, with short, grayish wool and long, reddish brown bristles; spines 0–12, very variable in length, number and color on different forms and plants from different localities, mostly marginal, white or variously tinged with red or brown, slender, twisted and flattened, some reaching a length of 3 in.: fls. yellow, darker within, 2–2½ in. wide: fr. broadly ovate or subglobose, ¾–1 in. in diam., armed with numerous rather short spines; seeds comparatively large. West-central U. S.—A species of wide distribution and very variable, some high mountain forms entirely without spines, while other forms are armed with a close network of closely interwoven ones. A number of the forms have been segregated as varieties, of which the best known are **rufispina, platycárpa, microspérma, albispina** and **trichóphora.** All the forms appear to run together and the varietal distinctions are of doubtful value. Hardy in Massachusetts.

30. **rùtila,** Nutt. A low, diffuse plant, ½ to 1 ft. high: joints tumid, readily becoming detached, and covered with a close network of slender, interwoven, light gray spines, thick, elongate-ovate, 2–4 in. long: areolæ crowded, less than ½ in. apart, with short, white wool and yellow bristles; spines 3–5, sometimes a few short accessory ones, slender, reddish gray to white, with darker tips, 1¾ in. or less in length, larger ones often flattened and twisted: fls. red, 1½–2 in. wide: fr. broadly ovate to subglobose, usually armed with very long, interwoven spines; seeds comparatively large. Southwest United States.

31. **arenària,** Engelm. A diffuse plant with upright terminal joints, rarely reaching 1 ft. in height: joints thick, obovate, 2–5 in. long and half as wide, tumid, strongly tuberculate: areolæ crowded, ¼–½ in. apart, with sparse white wool and numerous yellowish brown bristles; spines very variable in number and size, 3–10, slender, flexible, white to ashy gray, usually 1 in. or less long: fls. yellow, 2–2½ in. broad: fr. ovate to globose, very spiny; seeds large and irregular. Southwest U. S.

32. **frágilis,** Haw. A small, prostrate plant, rarely more than 4 in. high: joints tumid, fragile, easily detached, oval, elliptical, or subglobose, 1–2 in. long and nearly as thick as broad, bright green: areolæ ¼–½ in. apart, with whitish wool and a few white to yellow bristles, which are much longer and more abundant on older joints; spines 1–4, occasionally a few small additional ones, weak, dark brown, the upper one usually longer and stronger than the others, rarely an inch in length: fls. greenish yellow, 1–1¼ in. wide: fr. ovate to subglobose, with few spines or bristles, mostly sterile, an inch or less long; seeds few and large. Rocky mountain region from British Amer. to New Mex.—Var. **brachyárthra,** Coult. A plant with more swollen joints, more numerous and stronger spines, smaller fls. and more spiny fruit. Colo., New Mex.

1548. Opuntia ursina. No. 27.

GE… UNIV.

33. **cylíndrica,** P. DC. A moderately branched upright plant, 10–12 ft. high, with main stem 2–2½ in. in diam., new growth dark green, the comparatively long (½ in.) lvs. persisting for some time: areolæ depressed, with a little white wool, a few white bristles and some long white hairs: spines at first 2–3, erect, rather stiff, ½ in. or less long, at first whitish yellow, later grayish: fls. rose-red, 2–2½ in. wide from end of joints: fr. pyriform, 2–2½ in. long, yellowish green, somewhat spiny. Chile.—Var. **cristàta** is offered.

34. **vestita,** Salm. A small, upright, numerously branched, ramifying plant a foot or more in height: joints rather short, 1–2 in. long and half as thick, usually dark green: areolæ with white to grayish wool and a number of long, rather soft, grayish white hairs; spines 4–8, either short, flexible and grayish yellow or four times as long (½–¾ in.), stiff and red: fls. 1–1½ in. wide, mostly lateral, dark red: fr. ellipsoidal, ¼–¾ in. long, bright red and covered with grayish wool. Bolivia.

35. **clavarioides,** Link & Otto. A low, numerously branched, spreading plant, 1–1½ ft. high: joints rather fragile and slender, ½ in. thick, cylindrical or somewhat clavate, frequently cristate, with numerous terminal, slender branches: lvs. extremely small: areolæ close together, small, with white wool; spines 4–10, sometimes fewer, very small and appressed, white: fls. 1–1½ in. wide and twice as long, greenish red: fr. elliptical, ½–¾ in. long; seeds with woolly hairs. Chile.—Var. **cristàta** is offered.

36. **Salmiàna,** Parm. A numerously branched, upright plant, about 3 ft. high, with very long, propor-

tionately slender branches: stems about three-fifths of an inch in diam., with rough, fissured or cracked, grayish brown or lead-colored bark, the terminal joints pencil-like, 3–10 in. long and ⅛–½ in. wide: areolæ on young growth with sparse white wool and few bristles, on older growth the bristles are very numerous and somewhat spine-like; spines 3–5, spreading, about ⅓ in. long, grayish: fls. 1 in. wide, red: fr. pyriform, 1–1¼ in. long, scarlet-proliferous, rarely fertile. Brazil.

37. **Dárwinii**, Hemsl. A small, numerously jointed, prostrate, ramifying plant a few inches high: joints globose to broadly obovate, 1½ in. in greatest diam., olive-green: areolæ with yellowish wool and few bristles; spines rigid, 1½–2 in. long, the lower ones shorter and darker: fls. only on top of terminal joints, 1–1½ in. wide, yellow: ovaries as large as the joints. Southern S. America.

38. **diademàta**, Lem. (*O. papyracántha*, Phil.). A low, moderately branched, spreading plant, rarely more than 4 in. high and forming dense patches several feet in diam.: joints 1–1½ in. long and nearly as thick, globose to broadly clavate, usually growing several in succession, one above the other, young growth bright green, soon becoming grayish: areolæ with abundant white wool and brownish black bristles; spines 1–2, papery, flexible, white or brownish with darker tips, one-fifth (?) in. long and half as wide: fls. rather small, pale yellow. Argentine Republic.

39. **pulchélla**, Engelm. A small, spreading, numerously branched plant, seldom more than 6 in. high: joints ascending, 2½ in. long and ½ in. thick, obovate to clavate: areolæ crowded, with white wool, and yellowish bristles which become more numerous and larger with age; spines 10–15, of variable length, the central one flattened, flexible, somewhat papery, 1 in. long: fls. from the top of the joints, purplish to rose-red, 1–1½ in. wide: fr. broadly clavate, 1 in. long, with long, hair-like, flexible white spines, dry. Nev , Ariz.

40. **clavàta**, Engelm. A low, spreading plant, 4–6 in. high, forming dense mats of ascending joints 4–5 ft. in diam.: joints 1–3 in. long and 1 in. thick, armed with numerous short, flat spines: areolæ with white wool and rigid, white bristles; exterior spines 6–14, white, ⅛–¾ in. long, interior 4–7, larger, flattened, scabrous and ½–1¼ in. long, 1 of the central spines usually very broad: fls. yellow, 1½ in. wide; fr. long-clavate, yellowish, dry, 1¼–1½ in. long, armed with many white radiating bristles. Nev., New Mex.

41. **Gràhamii**, Engelm. A low, spreading plant 4–8 in. high, with thick, fusiform roots: joints 2–3 in. long and ½ in. thick, armed with long, dark spines, bright green: areolæ with white wool and numerous long, yellowish brown, rigid bristles which become very conspicuous on old joints; exterior spines 4–8, ⅛ in. long, interior 4–7, more rigid and longer (1½–2 in.), reddish to ashy brown: fls. yellow, 1½–2 in. wide: fr. ellipsoidal, 1½–1¾ in. long and half as wide, armed with many large, radiating spine-like bristles. New Mex., Tex.

42. **Schóttii**, Engelm. A wide-spreading, prostrate plant, 4–6 in. high, with numerous short, curved branches: joints short-clavate, rarely more than 2 in. long and armed with numerous dark-colored spines: areolæ with white wool and very few bristles; exterior spines 6–10, very variable, ½ in. long; interior usually 4, flattened or irregular, 1½–2 in. long, brownish red: fls. greenish yellow to reddish, 1½ in. wide: fr. short-clavate, the numerous areolæ covered with white wool and many short bristles. Texas, Mexico.

43. **Émoryi**, Engelm. A prostrate and spreading plant with comparatively large, long-clavate, curved joints and reaching a height of 8–12 in.: joints 4–7 in. long and 1–1½ in. thick, with large, elongated tubercles: areolæ remote, with white wool and a few long (½ in.) yellow bristles; spines numerous, exterior 10–20, ½ in. or less long, very bulbous at base; interior 5–10, brownish to reddish black, more or less flattened and sometimes 3 in. long: fls. yellow, reddish within, 1½–2 in. wide: fr. ellipsoidal, yellow, 2–2½ in. long and 1 in. wide, armed with numerous bristles and spines. Southwestern U. S., northern Mex.

44. **invícta**, Brand. A numerously branched, spreading plant, 10–14 in. high, bluish green and armed with many rigid, erect spines: joints 4–6 in. long and 2–2½ in. thick, nearly cylindrical: areolæ with whitish wool and yellowish red bristles; spines 15–25, exterior 6–12, ½ in. or less long; interior 10–15, very strong and rigid, 1–2 in. long, more or less flattened: fls. yellow, 1½–2 in. wide: fr. broadly obovate, dry, armed with numerous reddish spines and bristles. Lower Calif.

45. **Dàvisii**, Engelm. and Bigel. A procumbent, spreading shrub, with firm, woody skeleton, 1–2 ft. high: joints 4–7 in. long and ⅓–½ in. thick: areolæ with short, white wool and numerous straw-colored bristles; spines usually 8–13, exterior ½ in. or less long; interior 4–7, triangular, brownish, with lighter tips, ¾–1¼ in. long, very loose-sheathed: fls. greenish yellow, 2–2¼ in. wide: fr. clavate, 1 in. or more long, often sterile, spiny. Tex. to Calif.

46. **acanthocárpa**, Engelm. and Bigel. An arborescent, erect plant, 4–8 ft. high, with dense reticulate-tubular skeleton and ascending, spreading branches: joints usually 4–10 in. long, sometimes 20, and ¾–1 in. in diam.: areolæ with short, white wool and scanty bright yellow bristles; spines very variable in length and numbers on different plants, usually 8–25, 1½ in. or less long, with loose straw-colored or brownish sheaths: fls. greenish yellow, with reddish centers, conspicuous for stamens with stout red filaments, 1¼–1½ in. wide: fr. subglobose to pyriform, 1 in. in diam. and usually armed with many long, stiff spines. Ariz. and Calif.—A factory has been established at Tempe, Ariz., where the wood of this species is made into light furniture, picture frames, etc.

47. **echinocárpa**, Engelm. and Bigel. A low, spreading shrub, with reticulate woody skeleton, rarely exceeding 1¼ ft. in height: joints 1½–3 in. long, rarely 4–6 in., ¾ in. thick, somewhat clavate: areolæ with short white wool and a few coarse, straw-colored bristles: spines very variable in length and number, exterior 8–16, 1¼ in. or less long; interior usually 4 forming a cross, 1–1½ in. long, with loose white or straw-colored sheaths: fls. greenish yellow, 1¼–1¾ in. wide: fr. depressed-globose or hemispherical and armed with many long (1–1½ in.) spines on the upper areolæ. Utah, Ariz. and Calif.—The fruit of this species, like most others with dry fruit, ripens in the early summer, while most species with fleshy fruit do not mature them until fall or the following spring.

48. **Bernardína**, Engelm. A slender, branched, upright shrub, 3–5 ft. high, usually with several long, straight stems arising from the base: joints 4–24 in. long and ¾ in. thick, armed with numerous short spines: areolæ with grayish white wool and numerous yellow bristles; spines yellow or brownish, 8–14, usually with inconspicuous sheaths, ¾ in. or less long; fls. greenish yellow, 1–1½ in. wide: fr. obovate, 1 in. long, armed with numerous rather short spines. S. Calif.

49. **serpentìna**, Engelm. A prostrate, rarely ascending, sparingly branched shrub, a few inches to 2 ft. in height: joints much elongated, 6–20 in. long and ½–1 in. thick: areolæ with short, white wool and whitish bristles: spines comparatively short, usually [illegible]–9, sometimes 15 or more, yellowish or rusty, ½ in. or less long· fls. greenish yellow, 1–1½ in. wide: fr. hemispherical, ½–¾ in. in diam., armed with numerous short spines and long woolly hairs. S. Calif., Lower Calif.

50. **prolífera**, Engelm. An arborescent, thick-stemmed plant, 3–8 ft. high, with numerous horizontal, spreading branches, the erect trunk sometimes 8 in. in diam.: joints short-cylindrical, rounded at the ends, very succulent, tumid and readily detached, bright green, 2–6 in. long and 1¼–2 in. thick: areolæ with white wool and on older joints with numerous straw-colored bristles; spines variable, usually 6–10, with conspicuous, loose, yellowish or rusty sheaths and much-barbed, usually about 1 in. long: fls. 1¼–1½ in. wide, greenish red: fr. subglobose, ¾–1¼ in. in diam., light green, with few small spines and bristles, pendulous in clusters, frequently sterile. Calif., Lower Calif.

51. **fúlgida**, Engelm. A numerously branched arborescent plant, often 10–12 ft. high, with erect trunk 8–14 in.

in diam., having a thick, grayish, scaly, unarmed bark: joints congested toward the ends of the larger branches, ovate to ovate-cylindrical, 2–8 in. long and often 2 in. thick, very fragile and tumid, easily becoming detached and taking root, bluish green, somewhat glaucous: areolæ with white wool and bright straw-colored bristles; spines on young growth 5–8, increasing yearly until ultimately 30–50, finally deciduous, with loose, glistening, white or straw-colored sheaths 1½ in. or less long: fls. ¾–1 in. wide, pink: fr. obovate to globose, light green, pendulous, in large, proliferous clusters, sometimes 50 in a single cluster. Southwestern U. S. and North Mexico.—The common "Cholla" of the Arizona plains, where it often becomes a fair-sized tree and notable for its formidable armor of barbed spines completely hiding the surface of the plant.

Var. **mamillàta**, Coult. Differs in having fewer, shorter spines.

52. **Bigelòvii**, Engelm. An erect, compact plant, 4–6 ft. high, rarely higher, with fragile woody skeleton which does not appear in joints of the first year's growth, the most densely spine-covered and difficult to handle of the cylindrical Opuntias: joints readily detached and forming formidable burs, ovate, short elliptical to long and cylindrical, with rounded ends, readily breaking from the plant and taking root, pale green, fragile, tumid, terminal ones frequently 3–5 in. long and half as thick: areolæ close together, with white wool and pale yellow bristles; spines 10–20, some very small, increasing in number as stems become older, straw-colored, loose-sheathed, 1 in. or less long, completely hiding the surface of the plant: fls. greenish red, 1 in. broad: fr. very spiny, ovate, 1¼–2 in. long and one-third as wide, few-seeded, mostly sterile. Ariz., Calif.

53. **imbricàta**, P. DC. A wide-spreading, irregularly branching shrub, rarely more than 5 ft. high, the trunk and larger branches with dark, rough, unarmed bark: joints frequently 12 or 14 in. long and 1–1¼ in. thick, with very prominent long, cristate tubercles: areolæ with yellowish wool and straw-colored bristles; spines 2–5, of variable length, 1 in. or less long, loosely sheathed, white to straw-colored: fls. 2–2½ in. wide, light purple: fr. unarmed, depressed globose, with large tubercles, yellow, 1–1½ in. in diam., adhering to the plant and drying on the stems during the winter. Tex. and northern Mex.—Usually confused with *O. arborescens*, from which it differs in its smaller growth, different habit, much longer joints, larger, more prominent tubercles, and fewer spines. The fruit and flower also show marked differences.

54. **arboréscens**, Engelm. (*O. stellàta*, Salm.). An arborescent, numerously-branched plant, 4–8 ft. high, with trunk of larger plants having very rough, dark, unarmed bark: joints with moderately prominent, narrow, cristate tubercles, verticillate, horizontally spreading on mostly pendulous, moderately spiny branches, mostly 3–6 in. long and 1 in. or less thick: areolæ with dirty-white wool and small yellow to light brown bristles; spines 6–20, variable in length, 1 in. or less, central ones more loosely sheathed, horny or reddish brown, white to straw-colored sheaths: fls. purple, 2–3 in. wide: fr. unarmed or with few spines, conspicuously tuberculate, subglobose, 1 in. in diam., yellow to yellowish red. Southwest U. S.—Frequently confused with *O. imbricata* and *O. spinosior*, intermediate between the two. Differs from the latter in having much larger, more cristate tubercles, fewer spines and different fruit.

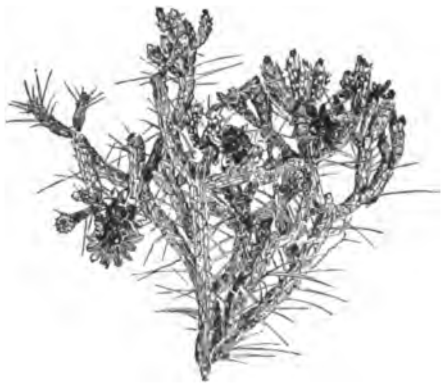
55. **spinòsior**, Toumey. A small tree, 6–12 ft. high, with numerous verticillate branches, forming a rounded head, the cylindrical trunk usually branching a few feet above the ground, and with rough, dark brown or grayish unarmed bark: joints verticillate and pendulous, ultimate ones usually 4–8 in. long and about 1 in. thick, dark green, frequently more or less purplish, with short, crowded rhombic tubercles: areolæ with white to reddish brown wool and usually few, small, variously colored bristles; spines 10–30, increasing in number yearly as the joints become older until finally deciduous, short, and rarely conspicuously sheathed, usually ½–¾ in. long: fls. showy, bright to dark purple, 2–2½ in. wide, in whorls at the ends of the joints: fr. elliptical to oblong, rarely obovate to globose, 1½–2½ in. long, yellow, frequently remaining on the stems during the second year. Ariz., northern Mex.

56. **Whípplei**, Engelm. and Bigel. A spreading, subprostrate shrub, rarely exceeding 2 ft. in height, with numerous ascending secondary branches, having short, crowded, prominent tubercles: joints variable, terminal ones clavate, 2–5 in. long and ⅔–¾ in. thick, mostly armed on upper half: areolæ with short white wool and a few short, light-colored bristles; spines white, very variable, on terminal joints, usually from 1–3 conspicuous loose-sheathed interior ones and several small, deflexed or radiating ones: fls. greenish yellow, crowded at the ends of the joints, 1–1¼ in. wide: fr. unarmed or with few spines, pyriform to subglobose, densely tuberculate, yellow or tinted with scarlet, ½–1 in. in diam., drying and remaining attached to the plant during the winter. Southwest U. S. and northwest Mex. —This plant is frequently confused with *O. spinosior*, probably from confusion in the original description.

57. **versícolor**, Engelm. A small, numerously branched tree, 6–10 ft. high, with rounded head and a short trunk, having smooth, light brown or reddish brown, unarmed bark: joints much elongated, usually 6–12 in. long, sometimes 20, ⅔–¾ in. thick, deep green, more or less colored with red and purple: areolæ with short gray wool and lighter colored bristles; spines variable, on terminal joints, usually from 5–13, older joints with 10–20, rarely, however, increasing in numbers after the second year, reddish brown, with inconspicuous, close-fitting sheaths, ¾ in. or less long: fls. bronze-colored, 1–1½ in. wide: fr. pyriform to clavate, of same color as joints, never yellow, sometimes tinged with red or purple, unarmed or with a few persistent short spines, 1–2 in. long. Ariz., northern Mex.

58. **tetracántha**, Toumey. An irregularly branching shrub, 2–5 ft. high, primary branches from a stout, upright trunk 2–4 in. in diam., and bearing numerous short lateral ones at irregular intervals: joints very variable in length, usually 4–10 in. long and ½ in. thick: areolæ with whitish wool and a crescent-shaped tuft of light brown bristles; spines 4, rarely more or less, ¾–1½ in. long, stout, loosely sheathed, straw-colored, flattened, strongly deflexed, not increasing in numbers on older joints: fls. greenish purple, ½–1 in. broad: fr. obovate to subglobose, ½–1 in. long, juicy, scarlet, unarmed, or with a few stiff deflexed spines. Arizona.—One of the most attractive of the cylindrical Opuntias on account of its numerous bright scarlet fruits.

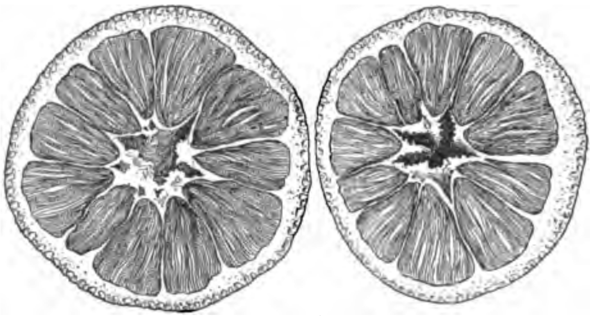
59. **arbúscula**, Engelm. A short, numerously branched, round-headed, arborescent plant, rarely reaching the height of 5 ft., but always with an upright, well-defined trunk, having rough, brown, unarmed bark: joints usually 2–4 in. long and ⅛ in. wide, easily broken from the plant: areolæ comparatively large, with white wool and brush-like tufts of long, slender, yellow bristles: spines yellow, usually 1, frequently a small, slender, additional one at either side, ¾–1½ in. long, loosely sheathed: fls. bronze-colored, ¾–1 in. wide: fr. unarmed, of same color



1549. Opuntia ramosissima. No. 61.

as joints, long, clavate, 1–2 in. long and one-third as wide, mostly sterile, fertile ones with a few remarkably large, irregular-spheroidal seeds. Arizona, Sonora.

60. **leptocaùlis**, P. DC. (*O. frutéscens*, Engelm.). An erect shrub, 2–4 ft. high, with long, slender, flexible stems branching from near the ground, and numerous lateral secondary ones, very short, usually unarmed and easily detached: joints about one-fifth to ¼ in. thick: areolæ with short, white wool and numerous, reddish brown, conspicuous bristles: spines usually 1, sometimes wanting, erect, stout, frequently 2 in. long, brownish or horny, with a loose yellow sheath: fls. greenish yellow, ⅓–½ in. wide, with deflexed perianth: fr. scarlet, succulent, obovate to oblong, rarely globose, ⅓–⅔ in. long, frequently proliferous, armed with tufts of long, reddish brown bristles. Southwestern U. S. and Sonora. Var. **màjor**, Hort., is advertised.—One of the slenderest of the Opuntias. It differs from other species in that the fls. do not open until late in the afternoon. Several forms of this plant occur throughout its range, some of which have been separated as varieties. One of the most frequent of the cylindrical Opuntias in cult.



1550. Orange (Satsuma).

Showing the multiplication of locules or compartments.

61. **ramosíssima**, Engelm. (*O. tessellàta*, Engelm.). Figs. 1543, 1549. A spreading bush, 2–5 ft. high, with numerous slender branches arising from a short trunk, 1–3 in. thick, and having dark, scaly bark: joints ashy to bluish gray, variable in length, ultimate ones 2–6 in., ¼–⅓ in. thick: areolæ with sparse white wool and a few small yellow bristles: spines sometimes wanting (Fig. 1537), usually 1, stiff, erect, 1½–2 in. long, loosely sheathed: fls. reddish purple, ½–⅔ in. wide, dry, narrowly obovate, 1 in. long, ⅓ in. wide, with 1 or 2 seeds, frequently sterile, armed with numerous long, grayish bristles. Ariz., Calif., Sonora.

O. coccinellífera, Mill.=Nopalea.—*O. corrugàta*, Salm., is advertised, but little known.—*O. glaucophýlla*.—*O. Kleiniæ*, DC. is also advertised.—*O. lùrida* is probably O. arborescens.

J. W. Toumey.

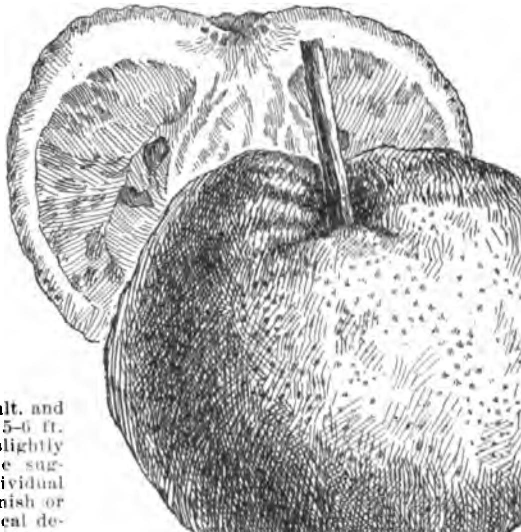
ORACH, or French Spinach, is a pot-herb cult. and used much like spinach. It is an annual, grows 5–6 ft. high, has furrowed stems and arrow-shaped, slightly crimped lvs. of soft texture. The inflorescence suggests that of amarantus-like plants. The individual fls. are very small, devoid of petals, and greenish or reddish according to variety. For a more technical description, see *Atriplex hortensis*.

There are three main types of Orach, based on the color of the lvs. The white variety is the one most commonly grown. The lvs. are pale green, almost yellow. The red or dark red variety has stems and foliage of dark red color, which disappears in cooking. It is occasionally cult. as an ornamental foliage plant under the name var. *atrosanguinea*. The green variety is perhaps the most vigorous type. The lvs. are rounder than those of the white var. and less toothed. So far as is known, only the red and white varieties are offered in America. The seed is usually drilled into the open ground in early March. The plants are used in their young state. They bear hot weather fairly well, but soon run to seed. Monthly successional sowings are therefore desirable. Orach is little known in America.

W. M.

ORANGE. Plate XXIII. The Orange is one of the oldest of cultivated fruits. Its nativity is still in doubt, but it is probable that it is indigenous to the Indo-Chinese region. It is now widely distributed in all warm-temperate and tropical countries, in many of which it has run wild and behaves like a native plant. In parts of Florida the Orange was found wild when permanent settlements were made, but it had probably spread from stock that was introduced by the early Spaniards. In stature of tree and character of fruit, the Orange has varied immensely. Normally, the fruit contains ten compartments or locules; but under the influence of domestication these compartments have been increased, and in some cases a secondary axis, with its accompanying locules, has been thrust into the center of the fruit, causing the "navel" appearance of some varieties. Fig. 1550; also Fig. 476, p. 322. These navel Oranges, of which the Washington Navel or Bahia is the best known, are chance seedling varieties, as other varieties are. The immediate cause of this particular kind of variation is unknown. The Washington Navel was introduced from Brazil in 1870 by the late Wm. Saunders, of the U. S. Dept. of Agric., and by him distributed as the Bahia (see Van Deman, Rept. Dept. Agric, 1886, p. 267). In recent years, some of the odd and grotesque types of Japanese Oranges have been introduced into this country, but they will probably always be curiosities rather than commercial pomological products. See Figs. 1551–2 and cf. Shinn, A.G. 1890, 333–6.

There are three well-developed Orange regions within the confines of the United States: central and southern Florida; the delta region of the Mississippi; California. Parts of Texas and the Mexico-Arizona region will no doubt develop into commercial Orange sections in the near future. Until within recent years a large part of the Oranges consumed in this country have come from



1551. The Natsu-dai-dia, or Summer Orange of Japan.

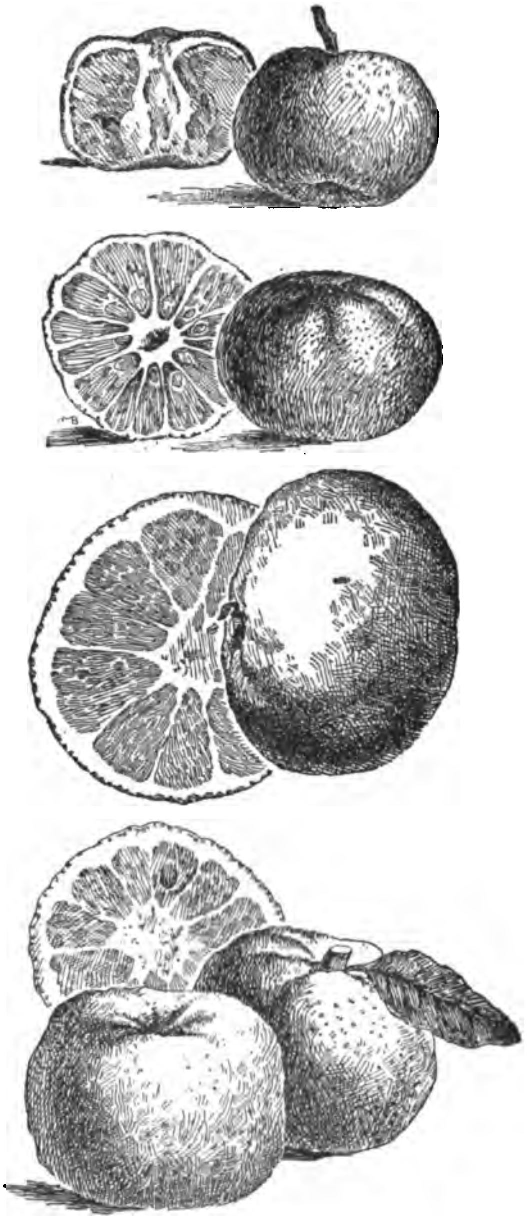
The fruit is large, suggesting a shaddock. It is not eaten till the second summer.

Mediterranean regions, but the Florida Orange has taken the place, to a large extent, of the imported fruit. Since the great Florida freeze of 1895, however, the California Orange has come to be much better known in the eastern states.

Fifty years and more ago, Oranges were commonly grown under glass in England and parts of the continent. At that time there was no rapid transportation between the Orange-growing regions and northern countries, and the Orange fruit was a luxury. Special houses, known as orangeries, were devoted to the culture of the fruit. The trees were ordinarily grown in large tubs or boxes (Fig. 1553), and were kept in the open in summer and were placed in the orangery in winter. These orangeries were scarcely greenhouses in the modern understanding of the term. In many cases they had slate or shingle roofs, the sides only being provided with an extra amount of glass in the shape of windows. Some of them, however, were houses with glass roofs. As imported Oranges came to be more common, these Orange houses gradually fell into disuse. It is doubtful if there are any of these establishments now standing in this country, but one sees them occasionally in Europe. As the Orange trees disappeared, other plants were grown in the house, so that an orangery came to mean a particular kind of house in which plants are grown that will thrive in conditions suited to the Orange. It came to be no uncommon thing to see orangeries in which there were no Oranges.

The Orange tree is still a popular subject in conservatories, however, and in window-gardens. In the latter conditions it rarely produces fruit of any consequence, but the shining evergreen foliage and the very fragrant flowers make the plant interesting and desirable. The plant is subject to scale and mealy bug, and constant attention must be given to syringing and sponging the foliage. The leading difficulty in the growing of an Orange tree in the dwelling house is a tendency to keep it growing the entire year and to keep it too wet at the roots. After the fruiting season, in late fall or early winter, the plant should be allowed to rest for a time in order to harden its wood for the next year's bloom. It may then be kept at a temperature of 40° to 50° and fairly dry at the roots. Water should not be withheld entirely, however, because the plant should be kept in such condition that the foliage will not drop. After a period of relative inactivity of one or two months, the plant may be set in a sunny place and given a somewhat higher temperature, and water and liquid manure may be applied at the roots. It should be in bloom during the summer and early fall. Best results are secured if the roots are somewhat confined. When the plant is small, it may be potted on from time to time; but after it has attained the height of five or six feet, it should not be given more root room than a small tub or a half barrel. Ordinarily, it will not need repotting for several years at a time after it has attained this size. Some of the surface soil may be removed from time to time and fresh soil added and liquid manure applied. Usually the stocks which are used are grown from seeds, and the plants vary as peaches or apples do. Some of the plants may give desirable fruit, but the larger part of them will give fruit of indifferent or even inferior quality. If the best kind of fruit is wanted, the young plants should be budded after they are well established in the pots. Buds may be secured from any tree that bears a desirable fruit, or they may be obtained from the South.

In recent years the Otaheite Orange (described in Vol I, page 323) has come into prominence as a pot-plant. Fig. 1554. It is a dwarf form of the common Orange species. It is undoubtedly the best form of Orange for growing in the house. The fruits are small and handsome, and the flowers have a pinkish tinge and are very fragrant. These plants will bloom and bear when not more than a foot high if the roots are somewhat confined or the plants not overpotted. Usually they will bloom the greater part of the year, but, like most hard-wooded plants, the best results are secured if they have a period of rest, as described above. The temperature for all Oranges should be relatively low; that is, it should be the temperature of the intermediate house or one which will grow carnations, chrysanthemums, geraniums, and the like.



1552. Japanese types of Orange.

Top, Sakura-jima, small, dwarf in growth, coarse in quality. Second from top, Shiriwa-koji, sweet and solid, of good quality, the rind thin and yellow. Oonshiu or Satsuma, one of the "kid-glove" class. Kawachi, also a "kid-glove" Orange.

There is much literature on the Orange, but there is no full and comprehensive treatise on Orange culture in North America. An authoritative general work on Oranges is Risso and Poiteau, "Histoire et Culture des Oranges," Paris. On the oriental forms and histories of Oranges, one should consult Bonavia, "The Cultivated Oranges and Lemons of India and Ceylon," London, 1890. The American books on the Orange are as follows: Garey, "Orange Culture in California," San Francisco, 1882; Moore, "Treatise of Orange Culture in Florida, Louisiana and California," New York and Jacksonville, Third Edition, 1883; Manville, "Practical Orange Culture: including the Culture of the Orange, Lemon, Lime, and other citrous fruits as grown in Florida," Jacksonville, 1883; Spalding, "The Orange: Its Culture in California," Riverside, 1885. One should also consult Wickson's "California Fruits," and the publications of the California State Board of Horticulture.

For an account of the Orange from the botanical point of view, see *Citrus*. L. H. B.

ORANGE CULTURE IN FLORIDA.—The foundation of Orange culture in Florida was laid, it is believed, by the accidental distribution of sour Orange seeds by the Indians, who obtained the fruit from trees planted by the Spaniards in early days, and which were probably grown from imported seeds.

These sour Oranges were carried from camp to camp, and the seeds thus scattered through the northern and central parts of peninsular Florida found congenial soil and conditions in the open hardwood forests and live-oak groves of that region, and in time formed wild groves of great extent, always in places where more or less protected from sun and radiation by towering live-oaks, magnolias and similar trees.

Sweet Oranges were grown to some extent for family use even before the civil war, but in the absence of transportation facilities were considered of no commercial value.

Between 1865 and 1870, however, the Orange trees along the banks of the St. John's river began to attract attention as a profitable investment, and a little later an enterprising horticulturist bought a portion of a wild grove in the interior, near Orange Lake, and budded the tops of the sour trees to sweet varieties. The profits were prompt and large, so much so that this pioneer, who began with an investment of only $1,000, had a crop valued at $231,000, for the year of the great freeze, 1894–5.

Many of these wild groves were injured or destroyed, however, by the removal of the protecting live-oaks, and being located on about the 30th parallel of latitude, the Oranges themselves had to be marketed early in the season to avoid destruction by frost. By 1880 cultivated groves spread over all parts of Florida where railroad or steamboat transportation was accessible; the Indian river hammocks being justly celebrated for the quality and abundance of the fruit, while almost every kind of soil and exposure had its champions as best for Orange culture. The winters for several years prior to 1880 were almost frostless, and the rains abundant all the year round, so that the growth of well-cultivated young groves was phenomenal, and the whole northern half of peninsular Florida gave itself up to Orange culture with reckless enthusiasm—it was estimated that the Orange at 12 years of age would pay from 10 to 150 per cent interest on a valuation of $100 for each tree, and in the case of individual trees even the highest figure was sometimes realized.

1553. Tub-grown Orange tree.

1554. Otaheite Orange in a pot.

The first check to this state of affairs was received in 1886, when a three days' blizzard from the northwest swept over the state and cut back or at least defoliated all the Orange trees down to the 29th degree, and still further south in all but the most protected stations. This injury, however, was only temporary in most cases, and while much of the crop of 1885–6 was lost, there was no diminution in the crop of the following year, although the trees themselves had received an evident check.

From 1886 on, there has been a succession of frosts, generally not sufficient to hurt old trees but enough to destroy or seriously cripple nearly all the young groves north of the latitude of Tampa, so that few, if any, new groves have been brought into successful bearing north of that point since 1886.

In December, 1894, a still more severe northwest blizzard defoliated all the trees as far south as the Manatee river, and this was followed in February by another similar freeze, which caught the trees covered with tender shoots and young foliage, with active sap, and killed most of them to the ground from Tampa north, and, moreover, so enfeebled them from the repeated shocks that the majority were unable to rally, and are to-day either dead or worthless. The loss to the Florida Orange industry by this double freeze is reasonably estimated at $100,000,000.

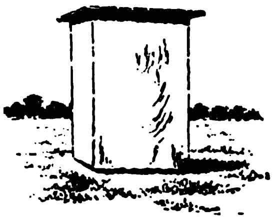
The crop of 1894–5 was the largest hitherto produced, and estimated at 6,000,000 boxes, each of 2 cubic feet. The following year about 75,000 boxes were produced, all from south of the latitude of Tampa, and the crop has been increasing till that of 1900–01 is estimated at 1,000,000 boxes, 95 per cent of this coming from regions south of Orange county, which just about reverses the proportion observed "before the freeze."

The following table was supplied by Mr. E. O. Painter, editor of the "Florida Agriculturist," after consultation with the officers of the Florida Fruit Exchange, and may be relied on as substantially correct:

FLORIDA ORANGE CROPS.

	Boxes	
1884–85	600,000	
1885–86	900,000	
1886–87	1,260,000	
1887–88	1,450,000	
1888–89	1,950,000	
1889–90	2,150,000	
1890–91	2,450,000	
1891–92	3,761,843	
1892–93	3,400,000	
1893–94	5,055,367	
1894–95	6,000,000	(Est.)
1895–96	100,000	
1896–97	250,000	
1897–98	216,579	
1898–99	225,000	
1899–1900	400,000	
1900–1901	1,000,000	(Est.)

Many groves in Orange county and northward have been brought into fair condition by banking the trunks with earth during the winter so as to limit the injury by frost, and if another series of frostless winters like those between 1870 and 1880 were to occur, these groves, with others newly planted, would gain sufficient age and size to defy the ordinary frosts and make this region again productive. Many acres have recently been shedded over with slats or canvas—usually removed in summer—and, thus protected from the cold, are promising large returns on the heavy investment required to build the sheds—from $600 to $1,000 per acre. Figs. 1555–6. They are usually heated during the coldest nights, either with open wood fires or stoves burning coke or coal. The most extensive shedding operations are those of John B. Stetson, of Deland, who has 37 acres covered, various systems of protection being employed on different plots.



1555. Movable shed to protect an Orange tree from cold.

It has a board top and cloth sides. The sides can be removed, allowing the trees full light.

The Orange has been grown on the most varied soils in Florida, but successful groves have been mainly on "high hammock" and "high pine," and the greatest profit, as a rule, has been from the hammock groves, where seedling trees came into bearing much earlier than on pine-land, and both seedling and budded trees produce more abundant crops.

The Orange groves of California and Arizona are subjected to greater winter cold than those of Florida, but suffer comparatively little damage from it, since the winters are more uniformly cool and dry and the trees are consequently dormant, while the usual warmth of a Florida winter keeps vegetation constantly in more or less active growth, and hence more sensitive to sudden frosts. Thus in 1894–5 not only Orange trees but peach and mulberry trees and old Wistaria vines—all hardy as far north as Canada when dormant—were frozen to the ground. The mean temperature has changed little, if at all, during this alternation of mild and frosty cycles of years; indeed, the mean of maximum and minimum observation taken daily at Mount Dora, Fla., for six comparatively frostless years prior to 1886 was half a degree F. colder than the mean of six years of injurious frosts subsequent to 1886.

The Orange tree is a gross feeder, and in the sandy soils best adapted to its culture in Florida can use to advantage large amounts of commercial fertilizer, provided the ammonia is balanced by abundant potash and care is taken to avoid an excess of crude fermentable materials containing nitrogen, such as cottonseed-meal and dried blood.

On the moister grades of hammock land, such, for example, as those bearing the fine groves near the Manatee river, it is considered unsafe to give more than 10 pounds of commercial fertilizer a year, even to the oldest bearing trees, on account of its liability to produce disease; and additional sulfate of potash is used, even with standard brands of fertilizer rich in potash. On the high pine-land at Deland, profit has been found in applications of 80 pounds to the tree, or 2 tons to the acre, but the average amount used by successful growers is 20 to 30 pounds to the tree of special brands, costing from $30 to $37 per ton.

So long as the soil is not unduly depleted of humus, frequent cultivation is an important factor in producing rapid growth of Orange trees. As an experiment, a seed was planted and hoed every day except Sundays for four years. It was then about the size of an average eight-year-old tree in the region—one celebrated for its fine and fast-growing Orange groves—and bore four boxes of Oranges—about what would be expected from an eight-year-old seedling in that place.

Soils.—The surface soils of peninsular Florida are almost wholly of subaërial origin—that is, are composed of particles cast up by the waves of the sea and carried to their present positions by the wind. The process may be observed at the present day in some places on the coast, for example, where a gentle slope inland from the beach ends in a thicket of underbrush and small trees. At such a place the slope abruptly ends at an angle of 45 degrees, and whenever a breeze blows from the sea on a dry day a continuous stream of sand may be seen blowing over the crest and falling down the steep angle, gradually engulfing and burying the thicket in a layer of sand sometimes 15 feet in depth. The trees and bushes form a wind-break and thus check the blowing of the sand towards the sea when a land breeze prevails. As might be expected, the elevations in peninsular Florida are small, the highest point of the peninsula being but 300 feet above the sea-level.

The result of long ages of wind action on a soil composed wholly of fine particles has been to assort these particles according to weight and size and other physical characteristics into innumerable patches, small and great, each of which has its own peculiarities in its reaction upon the vegetation which it bears. This makes the soil capabilities of any tract of land a bewildering puzzle to the newcomer, and the only certain clue to its solution is found in the character of the vegetation already growing on it. Chiefly in accordance with this natural growth, the soils are classified as high hammock and low hammock, high pine and low pine, or flatwoods, prairies, scrubs, bays and shell-mounds. Any land bearing an abundant growth of hardwood trees—live-oaks, hickories, magnolias, etc., is hammock land, and if not less than 3 or 4 feet above water is suitable for Orange culture. The larger and denser the hardwood growth the better the Orange will flourish on it. An elevation of 8–10 feet above water is preferable to lower hammock. The word hammock is the aboriginal Indian name for hardwood forest.

"High pine" land is characterized by the predominant growth of the long-leaved or yellow pine. This is also suitable for Orange culture; the larger the pines the better the land. If the pines are intermixed with willow-oaks and an occasional hickory and cabbage palmetto, the land is sometimes called half-hammock, and such land is more fertile than ordinary pine land. Blackjack oaks, on the contrary, are an indication of poverty of soil.

1556. One method of protecting Orange trees in Florida.—A slat shed.

As fires sweep over the pine lands annually, burning the resinous pine straw, there is a good deal of finely divided charcoal in these soils but very little humus, while in hammock soil the percentage of humus is often very large.

Flatwoods (low pine land) is characterized by several small-coned species of pine, which otherwise very much resemble the long-leaved pines. This land is often underlaid with hardpan a foot or two below the surface. Much of it is subject to overflow in the rainy months, and when overgrown with gallberry bushes it is useless for Orange culture.

1557. Florida Orange grove.

A prairie is a tract in the flatwoods overgrown with grass only and covered by standing water during a part of each year.

A scrub is a tract of white sand—often like clean granulated sugar—overgrown with dwarfed live-oaks and other bushes, mostly of the heath family and usually only a few feet high, with scattered spruce-pine trees, the open spaces often covered with reindeer moss and allied lichens. It is entirely worthless for Orange culture, though suited for pineapples if richly and constantly fertilized.

A bay or bayhead is a deep accumulation of humus—muck and peat. When drained, such lands make the best vegetable gardens.

The shell-mounds are, as their name implies, accumulations of the shells of marine or fresh-water mollusks, intermixed with a little sand and humus. They are apt to be thirsty, though fertile when plenty of water is supplied, and although the Orange will grow upon them and produce fine, silky-skinned fruit, the trees are not long-lived, as a rule, and seem subject to disease. The finest silky-skinned fruit is rarely, if ever, produced by trees in vigorous health and rugged growth.

The tendency of Orange trees on pine land, especially bottomless pine lands—those not underlaid with clay—is to wood growth, and the postponement of abundant fruiting till a great age has been reached; this is especially the case with seedling trees. The coarser the pine land soil in texture, the longer, as a rule, will the Orange tree take to reach a bearing age, sometimes requiring twenty or thirty years, even with abundant fertilizing, on the coarser sands. On the hammocks, seedlings fruit at a much earlier age, and budded trees often dwarf themselves from overbearing.

South of the 27th degree of latitude there are some rich, red, loamy soils, while the sand consists largely of coral debris instead of quartz. In these southern regions the Orange is supposed to flourish only upon the scrub lands, being dwarfed and subject to disease on the otherwise rich and fertile red soils.

When not injured by frost, the Florida Orange tree is immensely productive of thin-skinned delicious fruits. A good Florida orchard or grove is shown in Fig. 1557. A new tree arising from the stump of a frozen tree is shown in Fig. 1558. Many groves have been renewed in this way.

Varieties.—Of the leading varieties, Homosassa may be taken as the type of the finest seedlings originating in Florida; other Florida seedlings have been named, but they are much alike. Jaffa and Majorca are typical of the best thornless foreign varieties; the Washington is the only navel Orange sufficiently productive to warrant planting in Florida, where none of the navel Oranges are as prolific as other sorts. Of the kid glove Orange, the Tangerine has quite displaced the Mandarin in Florida, the brighter color of the former always ensuring a higher market price. Satsuma has the merit of being earlier than the Tangerine and possibly being hardier, hence is largely planted, though not equal in appearance or quality to the Dancy Tangerine. Of the two varieties of Kumquat or Cherry Orange, the "oblong" is the best market fruit, the "round" being too variable in size and often too small.

THEODORE L. MEAD.

ANOTHER VIEW OF ORANGE CULTURE IN FLORIDA.—In primitive Orange culture the tree was a seedling from selected fruit, and even at this time the majority of bearing trees in Florida are seedlings. Seedlings are late in coming into bearing, their fruit is of variable quality, and the roots of sweet Orange trees are likely to get the "foot-rot," or *mal-di-goma*. Therefore growers are now more careful as to stocks used and seldom plant the sweet seedling tree, but graft or bud on more suitable roots. On very high land of best quality which is deeply drained, it is possible to raise the sweet seedling without great danger from foot-rot. As long as the roots are healthy the trees produce fruit in abundance, and many growers contend that the fruit produced, whether of Orange, lemon or pomelo, on sweet Orange stocks is better in quality of juice, has less "rag" and a thinner skin, and hangs on the tree in perfection longer than when grown on other roots.

The sour Orange as a stock for other citrous trees is a contestant with the longer grown sweet Orange, and as it is free from gum disease, commonly called "foot-rot," and yields abundant crops, it is planted on soils which naturally suit it; these are low, rich lands of both pine and hammock. In the central part of Florida it has run wild, and grows in the open hammock woods where some years ago the best thickets were budded or grafted to the sweet Orange, and up to 1895 bore enormous crops of fruit. The sour Orange does not do so well on higher land, though sometimes planted there, and will not grow at all in dry, coarse sand, where the "rough lemon" manages to exist and produce fruit.

This "rough lemon" seems to be a natural hybrid citrus, with leaves and flowers somewhat resembling the commercial lemon and with large, round, coarse fruit with a lemon's acidity, but with the appearance of a coarse sour Orange.

1558. Sprout-grown Orange tree.

For quickness of growth and prolific fruiting, no citrous tree compares with the "rough lemon" as a stock for Oranges, lemons, etc., and growers are more successful with it than with any other stock on diverse soils so far tried.

Another prominent stock for citrous trees is the wild hardy *Citrus trifoliata* of Japan. It is a very thorny deciduous tree of somewhat dwarf habit, succeeding well on good Orange land not too dry. It influences the cion growing upon it to a great extent and causes a considerable increase of hardiness against cold, as well as earlier ripening of fruit; the tree itself blooms very late in the spring and ripens its fruit comparatively early. In north Florida and along the Gulf coast it is now being largely planted, worked to all varieties of Orange, pomelo, kumquat, etc., with more or less likelihood of successful fruition. It will probably never be wanted as a stock in localities free from frosts. The Orange tree is also worked to a small extent on the roots of other citrous trees, as pomelo, lime, bitter-sweet Orange, etc., with more or less success, as the nature of the land determines.

Propagation of these various trees is usually effected by seed. For sweet seedlings intended for orchard planting, the seed is carefully selected from the fruit of very best qualities, and only the vigorous plants are saved; for the nursery, to be worked by budding or grafting to various sorts, the seed is taken from any fruit available, whether good in quality or not. The seeds are squeezed out of the fruit by hand, after cutting the skin, and not allowed to dry. The seed of *Citrus trifoliata* may be dried, as it keeps longer without loss of vitality.

Seed-beds are prepared by thoroughly digging and pulverizing the soil, which should be of a light or sandy nature, and, unless of very good quality naturally, should be manured slightly with composted stable manure or chemical fertilizer. Seed should be sown thickly on the loose soil and pressed down well before covering; soil of the same light nature should now be thrown evenly over the surface to a depth of about an inch, and if the bed is considerably exposed to the sun should be mulched lightly with straw or leaves. Planters usually provide a temporary shading for the beds or else select a situation shaded by trees or walls, although the seedlings will grow in full sunshine if only mulched, but require more attention in watering. After two to six weeks, according to the warmth of the weather, the seedlings will appear above the surface and must be kept as free as possible from weeds, insects and fungous diseases. "Damping off" causes much trouble, and whole beds may be lost unless sprayed in time to check the spread of this fungous trouble. Bordeaux mixture seems to be the best preparation to use, although thorough dusting with flowers of sulfur sometimes is effectual.

The seedlings at the age of six months, or say during the summer rainy season, may be planted in nursery rows, about 10 x 48 in. apart. Less risk of loss, however, results when transplanting is done in midwinter with one-year-old plants, which at this age should be 6–18 in. high, according to variety. Watering is necessary both at time of setting and occasionally afterward, unless rains are frequent enough to keep the ground well moistened.

Fertilizer is used on poor soil about three times per year in the nursery, and clean tillage is a necessity to produce healthy trees quickly. At the age of three or four years the seedlings are usually budded to the desired varieties just before the growth ceases in the autumn. In spring the tops are cut off a few inches above the live buds, which quickly push out and grow strongly the first few months. Care is now essential in keeping down sprouts from the stock and in training the young bud. Most growers drive a small stake at each stem and tie the shoot thereto with soft twine, topping it to induce branching at the desired height. After a full season's growth the young budded trees will be well hardened and available for planting out in the permanent orchard during the winter months.

Grafting the Orange, as well as all citrous trees, is not so certain a process as budding, the hardness of the wood and heat of a warm climate being against success. Bark-grafting, or sprig-budding, is practiced on old stumps fairly successfully, but other forms of grafting usually fail.

In starting an orchard, the character of soil and drainage must determine the kind of stock to be used. The distance apart for standard trees should be ample, 25–30 ft. seeming about right. Trifoliata stock may be set closer. The land must be staked off and holes thoroughly prepared some time before setting trees. If land is newly cleared and somewhat acid, the soil thrown out of the holes may be sweetened by a liberal mixture of fresh lime, and will be benefited if allowed to remain exposed to sun and air for two or three months, after which it may be thrown back and the surface fertilized (if necessary) a week or more before setting trees.

1559. Mandarin, a Kid-glove Orange.

The young trees ought to be judiciously pruned at the top to counterbalance loss of roots in digging, and part or all of the leaves may be removed if transplanting takes place in cool weather; the removal of leaves is additional security against loss, less water being needed to establish the roots. In summer, however, the hot sunshine makes it advisable to leave on some foliage to avoid burning or scalding. Winter transplanting is preferable in almost every case.

After transplanting, the trees will be greatly benefited by a mulching of straw, leaves, or trash, which will keep the ground cooler and moister, and in rotting add humus to the soil. Fertilizer during the first years may not be needed if the natural soil is rich, but by the time fruiting commences some elements will probably be needed. If the grower is undecided as to what his soil lacks, a series of soil analyses may be useful in giving a suggestion. Potash, phosphoric acid and nitrogen are the main elements in manures, and the formulæ used in mixing chemical fertilizers may be readily varied to suit each particular orchard. The fertilizer may be purchased ready mixed, or the grower by care and study can make his own mixtures, buying the various ingredients to best advantage. Sulfate of potash, bone-black, and sulfate of ammonia are safe and favorite chemicals for all citrous trees. Fertilizing is usually done in December and again in May or June; sometimes a third application may be necessary in early autumn to properly fill out the fruit.

Cultivation has been for some years along the same lines: light plowing about the time of the winter fertilizing followed by thorough harrowing all through the spring and early summer, keeping weeds and grass well under, and conserving the moisture through the spring drought. After the rains settle down in earnest, all cultivation is suspended and the orchard is sown to various soil-enriching forage-plants, or allowed to develop crab-grass. The abundant foliage of the forage-plants keeps the ground cooler and renders the tree less liable to scald during extremes of heat and moisture; the forage may be cut and cured for hay, but when so doing a return of such loss ought to be made to the orchard, to some extent, from the barn lots, or in applications of mulching or leaf-mold. At all events the orchard should be mowed previous to the time of fruit-gathering.

Since the destructive freezes of 1894–95 and the following three cold winters, growers in the upper portion of Florida have used various forms of protection against frost, for Orange trees. The most general work along this line has been the banking of tree-trunks with soil up to a height of 1–4 ft., which in the event of freezing carries the budded stem safely through the winter and saves considerable growth. This is only a makeshift, however, to preserve the budded variety and does not protect the top or bearing part of the tree, so that many forms of tents for covering the whole tree have been devised, with heating apparatus. Sheds have also been made with tight walls, covering large areas of trees and having either slatted or movable roofs: during severe cold, open fires, aided by the high walls, keep the temperature above the freezing point. There is also the possibility of warming the air by means of sprays of water, forced from set nozzles by a steam pump, as the temperature of well water in Florida is constantly about 75° Fahr. or warmer. Under sheds trees may be set closer and kept at the very highest state of growth, removing crowded trees from time to time as it may be expedient.

The gathering of the Orange crop may proceed somewhat at the will of the owner; picking, of course, proceeds with the ripening of the different varieties, the early sorts being fit to gather in October, weeks or months before medium and late ripening sorts: all varieties will keep in perfection for several weeks while hanging on the trees.

The fruit from all citrous trees should be cut off, and never pulled, as a rough treatment would cause early decay. Packing is carried on quite uniformly in a great degree of perfection through all the Orange sections of the country; the main essentials to success are a slight wilting of the fruit (two or three days), and a firm, but not extreme degree of pressure, in each package. E. N. Reasoner.

Orange Culture in the Mississippi Delta.—From the early settlement of Louisiana to the present day Orange culture has received attention in the lower Mississippi valley. Until recently the seeds of sweet Oranges were planted and the young trees transplanted in and around the yards and gardens. No extensive groves were grown until after the close of the civil war. At first groves of seedling trees only were planted and these proved exceedingly profitable up to the very cold spell of 1895, which destroyed nearly every one in the state. In the meanwhile extensive experiments had been made in budding the choice varieties of sweet Oranges on various kinds of stocks, and many of the experiments demonstrated the power of resisting the cold by certain kinds of stocks, notably the *Citrus trifoliata*. Accordingly many of the old groves and a number of new ones were planted in budded stocks, using the buds of selected trees of sweet Oranges and establishing them upon the *Citrus trifoliata*.

1560. The banking of Orange trees on the Mississippi delta.

Budded stock has thus entirely superseded sweet seedlings. The sour Orange, the bitter-sweet Orange, the rough lemons, the grape-fruit or pomelo and the *Citrus trifoliata* have all been used successfully as stock for the sweet Orange. In the meanwhile several hardy Japanese varieties, including the Satsuma, Mandarins and Tangerines, were introduced and budded upon various kinds of stock. In 1895, with the temperature going down to 15° F. in New Orleans, it was found that the combination of the hardy Japanese varieties upon the *Citrus trifoliata* alone withstood the cold. This experience caused an adoption of the *Citrus trifoliata* as the chief stock for future groves. Accordingly nearly all of the groves planted since that time have been with this stock.

But there is a frost limit beyond which this combination is destroyed. This was evidenced by the unprecedented freeze of February, 1899, which again destroyed nearly every grove in the state. Since that time Orange planting has made very slow progress, and only a few large groves are to-day to be found in the state. The industry is, however, so profitable that a renaissance may be expected at an early day. The budded trees bear early and yield profitable returns in three to five years after being transplanted in the grove. The city of New Orleans furnishes a home market for all that can be raised, and the Louisiana Orange is about one month ahead of those of Florida and several months ahead of California in ripening, and, therefore, reaches the market when, on account of scarcity, good prices prevail. These facts, coupled with the readily productive soil, requiring no fertilizers, and the abundant rainfall, dispensing with irrigation, make Orange culture exceedingly profitable in Louisiana, and the only drawback is an occasional blizzard from the northwest, which drives gulf-ward the usually balmy climate and temporarily chills the groves. At rare intervals these blizzards are so intense as to destroy tree and fruit.

How to protect groves against these destructive frosts is to-day the "burning question" with the Orange growers. Flooding the orchard with water from the river upon the approach of a freeze has been practiced upon a large scale without complete success.

The practice of banking the tree—piling the soil around the stem to a height of a few feet (Fig. 1560)—on the approach of a blizzard whose intensity and time of coming are usually predicted by the government weather bureau, is now almost universally adopted as the best protection against excessive cold. This banking retains vitality in the main trunk, and while the outer limbs are killed young shoots will start from the tree when the soil is removed and spring advances. This practice gives only partial protection. The tree is virtually destroyed, but new shoots from the protected trunk will soon appear and in a year or two the tree has resumed shape and is ready to bear a crop. The crop for the ensuing year or years is destroyed, but by skilful care the grower is enabled to secure a renewed plantation quickly.

The sweet, the sour, the Mandarin (Fig. 1559), Tangerine and Satsuma, the Shaddock, the grape-fruit, the Kumquat and the trifoliata, are all grown quite largely in Louisiana. The Myrtle and the Otaheite are occasionally found as ornamental trees.

The Orange is grown in this state directly from seed and from buds. Budding is done at any time of the year from early spring to late fall. When performed in the fall, the buds remain dormant through the winter. The various stocks have particular merits for special soils and other conditions, and several kinds are used, as already said; but when the chief obstacle to successful Orange culture is cold, all other considerations must be dispensed with and only the most resistant stocks used. These are, first, *Citrus trifoliata*, and, second, sour Orange. Hence nearly all the Louisiana groves are on these two stocks, a large majority being on the former.

Planting a grove is always preceded by a nursery. The latter is made by planting the seed of the *Citrus trifoliata* or sour Orange. When the young trees are one to two years old they are shield-budded with buds from selected varieties. One year after, these buds are large enough to be transplanted to the grove.

The soil of the grove is thoroughly prepared and pulverized, and well drained. The trees are planted at intervals of 20 to 40 feet apart both ways, and the grove is cultivated until the trees are large enough to shade the ground. After that only the weeds and bushes are kept

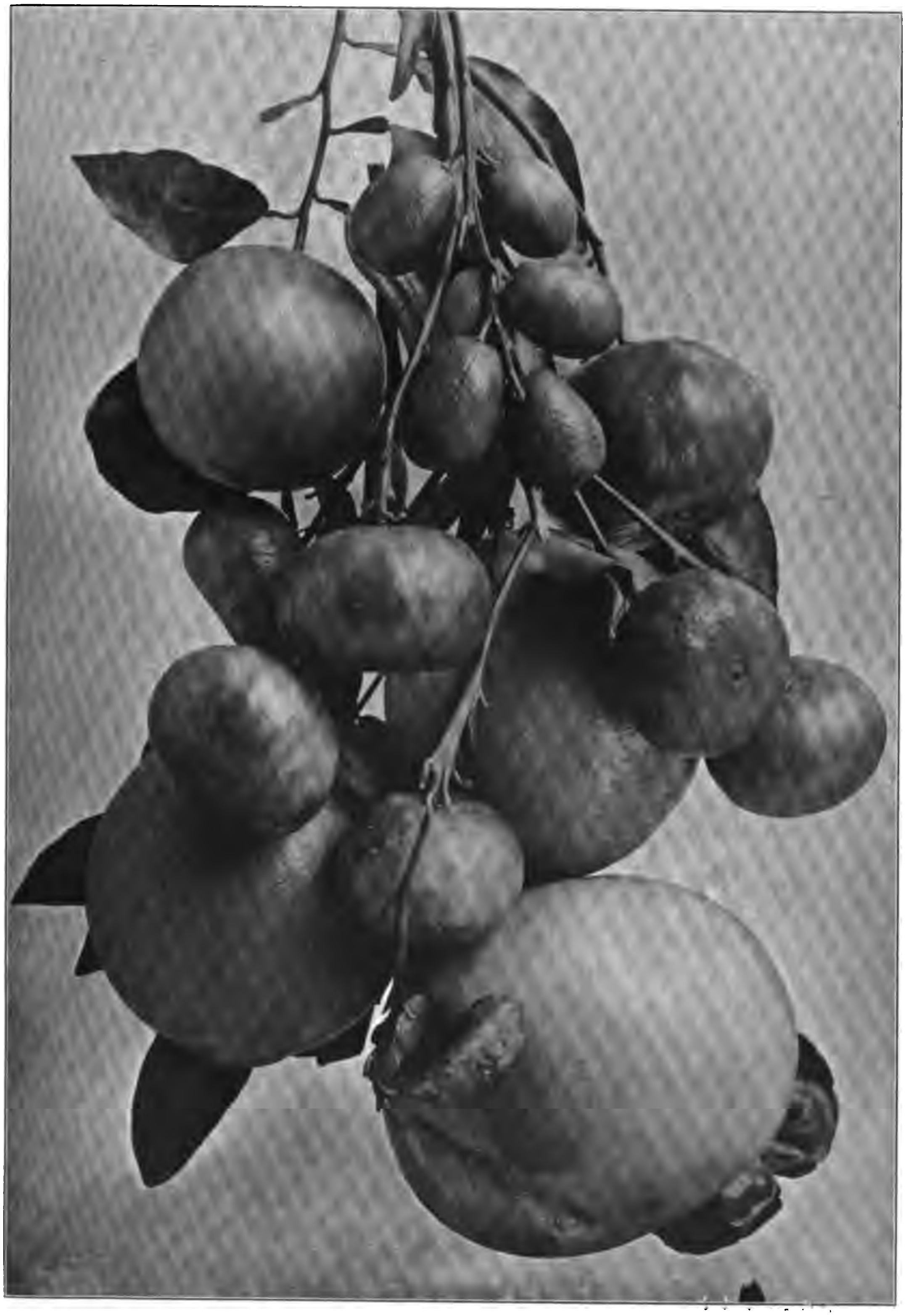


Plate XXIII. Citrous fruits (about one-half natural size).

ORANGES, Nonpareil and Parson Brown; MANDARIN, Cleopatra; KUMQUAT, Nagami; POMELO, Royal.

down. Late and early cultivation of an Orange grove is usually discouraged as having a tendency to induce a too luxuriant, sappy growth, which may be injured by subsequent frosts. The cultivation is usually performed with light plows or suitable cultivators.

In three years after a grove is planted the trees should begin to bear, increasing its products every year thereafter and becoming exceedingly profitable at 5 to 6 years. It has been found best here to head the Orange tree low, and prune it only for shape and comfort. Excessive pruning is never followed.

1561. Satsuma Orange (× ⅓).

When ripe, the Oranges are gathered by hand from ladders, assorted and packed in boxes or barrels and shipped to New Orleans. Before the late excessive cold the crop of the state was estimated at 500,000 boxes. It was quite small last year, as the result of this freeze.

A fertilizer containing 50 pounds nitrogen, 50 pounds potash, and 25 pounds phosphoric acid per acre is the one usually recommended in this state. It is usually applied in March or April. The following varieties have been grown in this state, which, for convenience, are here divided into three classes: first, early ripening; second, medium; third, late.

Of the first class there are numerous creole strains,—Beach Nos. 1 and 2, Boone Early, Brazilian, Centennial, Early Oblong, Foster, Homosassa, Nonpareil, Parson Brown, Peerless, Pride of Malta, and Whitaker, of the sweet varieties; and the Satsuma (Fig. 1561) and Mandarin, of the dulcis type. In the second class are Acapulco, Baldwin Nos. 1, 2 and 4; Beach No. 3, Bessie, varieties of Blood Orange, Circassian, Cunningham, Dulcissima, Exquisite, Jaffa, Joppa, Magnum Bonum, Majorca, Madame's Vinous, varieties of Navel Orange, Old Vini, St. Michael, Portugal, Prata, Queen, Ruby, Selecta, Star Calyx, Stark Seedless, Sweet Seville, Tahiti and Traveler, of the sweet Orange, and Tangerine, of the dulcis type. The third class—late maturing varieties—which are unpopular here on account of danger of frost during winter, are Acis, Beach Nos. 4 and 5, Dorr, DuRoi, Higley Late, Lamb Summer, Long, Maltese Oval, Mediterranean Sweet, Mott, Pineapple, Rio, Rivers Late, Simms Summer, Hart Tardif, and White, of the sweet, and King, of the dulcis type.

The Kumquat is grown both in the round and the oblong. A dozen or more varieties of the pomelo are also grown, while a few varieties of the sour Orange and shaddock are occasionally to be found.

W. C. STUBBS.

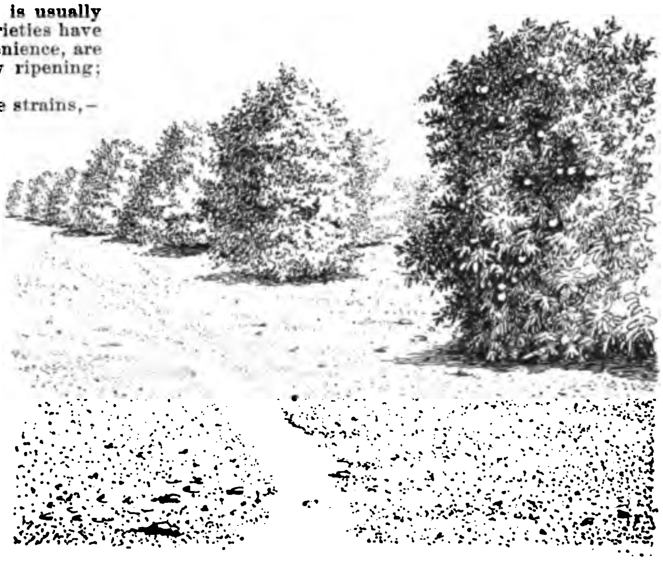
ORANGES IN CALIFORNIA (Fig. 1562).—In 1769 the Franciscans moved northward into what is now known as California. In connection with the Missions which they established they planted gardens and orchards, and the first Orange trees planted were from seeds, cuttings, or plants introduced by these worthy and thrifty padres.

The Missions were scattered over a wide range of country, as far up as Sonoma, some fifty miles north of San Francisco. The planting and care of orchards of both citrous and deciduous fruits was encouraged, but after the secularization of the Missions, in 1834, interest waned and they were neglected, so that in 1846 Fremont wrote of them that "little remains of the orchards that were kept in high cultivation at the Missions. * * * Fertile valleys are overgrown with wild mustard; vineyards and olive orchards are decayed and neglected."

At the Mission San Gabriel, in what is now Los Angeles county, were the most extensive orchards; and it was 86 years afterwards that the seed of an Acapulco Orange was planted at Sacramento, and four years later transplanted to Bidwell's Bar in Butte county, in the northern part of the state, and more than five hundred miles from the locality selected by the Mission Fathers for their first plantings.

While the climate of California, from San Diego in the south to Shasta in the north, is more or less suited to the Orange, and there are localities especially well adapted to its culture, there are some regions in the coast range as well as in the Sierra Nevada mountains where the low winter temperature prohibits its growth. The question of soil also enters largely into this problem, and considerable special knowledge is required in order to make a judicious selection.

The southern portion of the state was first selected as most promising, but since about 1890 every year has shown a vast widening-out and extension of the Orange belt. The business did not assume any commercial importance till 1880, when, and for some years afterwards, Orange groves were planted with feverish haste, consequent upon the enormous prices obtained for the product. As a natural outcome thousands of inferior trees were set out, unsuitable varieties in unsuitable localities, and seedlings which were of little value. The nurserymen could not grow stock fast enough, and the stock was often bought a year in advance. In a few years, however, Orange culture became better understood, until in 1899 the returns made by the county assessors showed an acreage in Orange trees alone, not including lemons, of 35,000, or 3,500,000 trees, nearly half of which were in bearing.



1562. A California Orange grove.

The foot-hill region of the Sierras was soon found to be capable of producing fine Oranges, notably in Placer county; later on in Kern, Tulare, and Fresno counties, and in the whole of the Sacramento and San Joaquin valleys were found large areas where Oranges could be grown as fine as those in southern California, and in some instances they were found to ripen earlier.

In some places, notably about Oroville in Butte county, near the extreme northern part of the Sacramento valley, the citrous industry thrives, side by side with gold-mining. The red, mineral lands, with abundance of water carried in ditches from the high mountains, grow to perfection the Washington Navel and other Oranges.

Though the temperature of the great San Joaquin valley is lower in winter than at points nearer the coast, the summers are warmer, and the Orange thrives in the sunshine, away from the coast fog, and the trees are healthier and less affected by scale insects.

The so-called "thermal belt" comprises some 1.500,000 acres of land adapted to the cultivation of the Orange commercially, and in every part of California, with exceptions above noted, Oranges may be grown in a small way, to satisfy the taste and embellish the home surroundings. This "belt" runs from San Diego to Tehama, and is nearly 700 miles long, and from two or three to twenty-five miles wide. Its altitude does not exceed 1,800 feet above sea-level, and from that down to 30 feet.

Orange seedlings were grown mostly from seed of imported Tahiti Oranges, and later from miscellaneous seed from any varieties. Seed from the Florida Sour stock has been largely used, but does not give general satisfaction. The young plants are budded in the nursery at two years old, and transplanted one or two years later to the orchard. Very many large, old trees have been "worked over," because the variety was found to be unprofitable. There are several ways of doing this, perhaps the most successful being to cut back the top of the tree, and to bud into the young shoots that will grow as a result of this cutting. In three years the old tree will have a new top, frequently with a good crop of fruit.

The Orange is a gross feeder, throwing out many and widely-spreading roots, and for this reason, though the soil may be naturally rich, it is necessary that it be plentifully supplied with fertilizers as well as water. This is done systematically and regularly, the trees being irrigated not less than once a month through the summer by means of shallow furrows opened by the plow on either side of the row.

The varieties considered most valuable for market are Washington Navel, Paper-rind, St. Michael, Malta Blood, Jaffa, Mediterranean Sweet, Parson Brown, Homosassa, and some of the Tangerine varieties. Of all these the Washington Navel is by far the most valuable. The first trees were imported from Brazil by William Saunders, of Washington, D. C., in 1870, and by him sent from there to California in 1873. The fruit is seedless, which adds to its value. Oranges are cut from the tree with small shears in preference to being pulled. After they have been kept in the packing-house for a few days to allow the rind to shrink, they are graded and packed in the regulation case, which is 11½ x 11½ x 26 inches. This work is done with the utmost care, and by experienced, skilled hands.

The output of Oranges from California, for the last two seasons (1897–8 and 1898–9), has reached the enormous amount for each season of 14,000 car loads, or 4,000,000 boxes, representing a value of about $6,000,000, f. o. b. California.

LEONARD COATES.

ORANGE, OSAGE. See *Toxylon.*

ORANGE ROOT. Same as Golden Seal, *Hydrastis Canadensis.*

ORCHARD. In America the word Orchard is used for any laid-out plantation of fruit trees. It is not applied to bush-fruit plantations, as it is sometimes in England. The Orchard is a part of every typical American homestead, although it may be of very small extent. The universal Orchard, except in the warmest parts, is the apple Orchard; pears and plums are probably next in domestic importance. Consult *Pomology.*

ORCHARD GRASS. *Dactylis glomerata.*

ORCHARD HOUSE, a name frequently used in England for glasshouses devoted to fruit trees. Consult the article on Forcing of Fruits, p. 598 (Vol. II.) of this work.

ORCHID. The Orchids are perennial herbs distinguished from other monocotyledons by the union of the stamens and pistils with the floral axis, forming a unilateral column. With the exception of the Cypripedineæ only 1 anther and 2 stigmas are fertile; in the Cypripedineæ 2 anthers and all 3 stigmas are fertile. The nearest relatives of the Orchids are the Scitaminaceæ. The Orchids form a vast group of plants (about 10,000 species) which, on account of the unusual transformation of their flowers, their strange shapes and glowing colors, and their varied adaptations for securing cross-pollination, are amongst the most fascinating of all families of plants.

PART I. POPULAR ACCOUNT OF ORCHIDS.

The peculiar interest which attaches to Orchids is due, in a great measure, to the endless variation of the flowers. Few Orchids not in flower are remarkable for their beauty. The barren canes of Dendrobium or the shriveled leafless pseudobulbs of Pleione are curious but scarcely beautiful. In many groups the color of the flower is of secondary importance. Many of the highly prized Cypripediums have only modest colors, while some cacti have brilliantly colored and lasting flowers, yet these have not become general favorites.

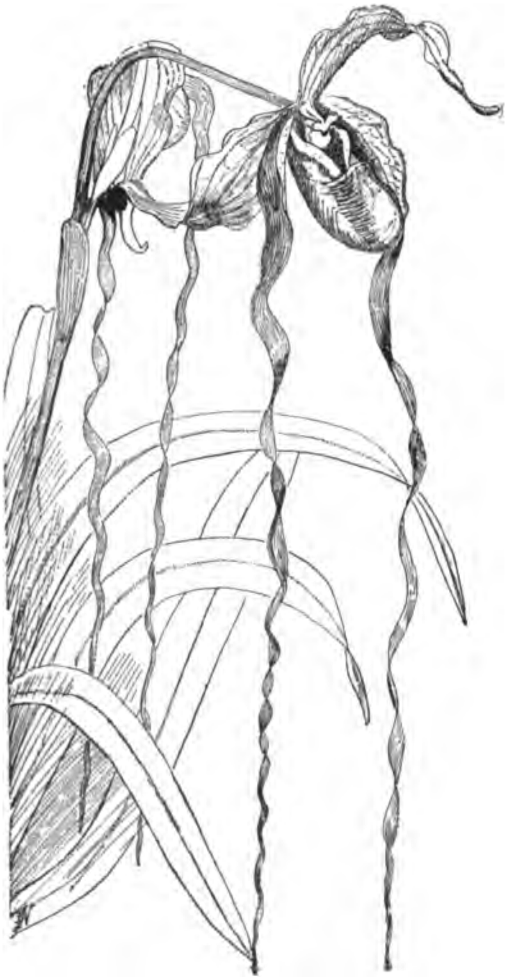
The great variety of the Orchid flower is produced, not by the creation of new organs, but, as everywhere else in nature, by the modification of parts already existing. The general plan of the Orchid blossom is like that of most of the flowering monocotyledons, as, for example, the lily.

The Sepals.—Of all the floral organs the sepals are usually least modified. They can be easily recognized. In some cases, however, they are sufficiently modified to change the appearance of the flower. Often the lower pair are more or less or entirely united (Oncidium, Cypripedium). In Masdevallia all the sepals are united into a short tube and then expand into blades terminating in long curious tails.

The Petals.—Of the second whorl of floral organs two only are generally petal-like, the third being transformed into the labellum. The two similar petals usually resemble the dorsal sepal. This resemblance is often carried out to a striking degree, which is most remarkable in cases in which these organs are unusually modified (*Oncidium Papilio*). Some peculiar modifications of the petals exist. In *Selenipedium caudatum* (Fig. 1563) they are elongated to an almost ludicrous extent, often attaining a length of three feet. In this species peloric flowers occur in which the third petal or lip is also petal-like (*Uropedium Lindeni*). In many other instances the petals differ greatly in size and form from the sepals (Bullophyllum, Masdevallia).

The Labellum.—The form or type of the flower depends greatly on the character of the labellum. This is the most wonderful and most modified of all the floral organs. It is often the most conspicuous part of the flower and is of the greatest importance to the plants, as Darwin has shown, in attracting insects and guiding them to the nectar, and hence to the pollen and stigmas of the plants. In Cypripedium and related genera the lip has the form of a sac often compared to a shoe, as the name Lady's Slipper indicates. The sides of the sac are folded inward, surrounding the column in such a way that an insect which has entered the labellum must crawl out through a narrow opening near the anther, which is thus brushed. Some of the pollen adhering to the body of the insect is thus carried to the stigma of another flower.

One of the most common forms which the labellum assumes is that of a trumpet-like tube inclosing the column. The front portion is expanded into a large, variously-shaped blade, which is often of a deeper color than the rest of the flower. The color becomes more intense toward the tube or throat of the labellum, which is further ornamented by ridges, crests, and markings, all of which serve to guide insects to the pollen masses and stigmas. The trumpet form of the lip is characteristic of many of the most beautiful South American Orchids, as Sobralia, Lælia, Cattleya, etc. In other genera the labellum is variously modified. Sometimes it is small and petal-like, sometimes greatly expanded, forming the most conspicuous part of the flower (*Oncidium tigrinum*, *Odontoglossum Londesboroughianum*).



1563. Selenipedium caudatum.

In other instances it is almost indescribably transformed (Stanhopea, Gongora).

In nearly all cases the labellum is provided with raised lines, crests, and markings for guiding the insects. In many genera the base is produced into a sac or spur, which secretes honey, or whose walls contain juices which are sought by insects. In the curious Madagascar Orchid, *Angræcum sesquipedale*, the spur attains the astonishing length of 10 or 11 inches (Fig. 1564).

The habit of Orchid plants is almost as varied as that of the flowers themselves. It is dependent upon the mode of life of the plants, which, in this respect, may be divided into three classes,—saprophytes, epiphytes, and terrestrial Orchids. True parasites are not known to occur in this family.

The saprophytic Orchids are the most reduced forms, devoid of chlorophyll, and depending for their carbon food upon the organic matter of the humus in which they grow. The subterranean stem or rhizome consists of a much-knotted coral-like mass which takes the place of roots. In most species the rhizome has been found to be invested with a fungus by means of which organic matter of the humus is absorbed and transformed into compounds available to the plant. The annual shoot is a brownish or yellowish stem bearing a few scales and a simple terminal inflorescence. Few, if any, of these plants are successfully cultivated, as it seems impossible to reproduce all the natural conditions. Common examples are the North American Corallorhizas.

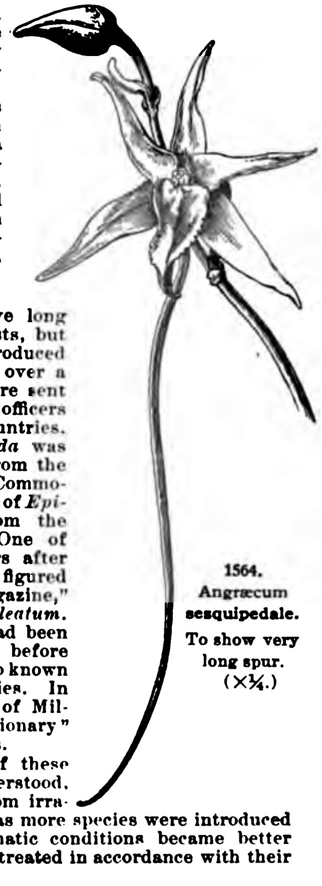
The epiphytic Orchids exhibit the most varied forms. These inhabit branches of trees, dead trunks, and often barren rocks in exposed places. They grow, without exception, in tropical or subtropical countries where a part of the year is unfavorable to growth. As a result of this, they have developed special food reservoirs, pseudobulbs, terminating each season's growth. In this group there are comparatively few plants of attractive habit. They are generally devoid of graceful foliage, each pseudobulb bearing a few stiff, leathery leaves. The older pseudobulbs become shriveled and leafless, detracting from the appearance of the plants, and in Pleione the plants are entirely leafless at the flowering time. In some of these, however, the pseudobulbs are numerous and closely crowded, and retain their foliage, making plants of neat, compact habit (Cœlogyne, Miltonia).

The terrestrial species include some of the largest and most stately Orchids of the tropics as well as most of the Orchids of the temperate zone (Habenaria, Orchis, etc.). Many of these are ornamental even when not in flower. The species of Sobralia are noted for their tall, reed-like stems well clothed with graceful foliage. In the tropics they often form dense thickets from 6–12 ft. in height. Most of the species of Selenipedium also have luxuriant foliage, which is attractive at all times.

Foliage Plants.—The Physureæ, a small group of Orchids distributed in tropical Asia and the Malay Islands, with a few species in Africa and North America, are remarkable for their beautifully variegated leaves (Physurus, Anœctochilus). The plants themselves are usually small, with the habit of Goodyera, a North American representative of the group. Variegated or mottled leaves occur also in some other groups (Cypripedium, Phalænopsis, and Oncidium).

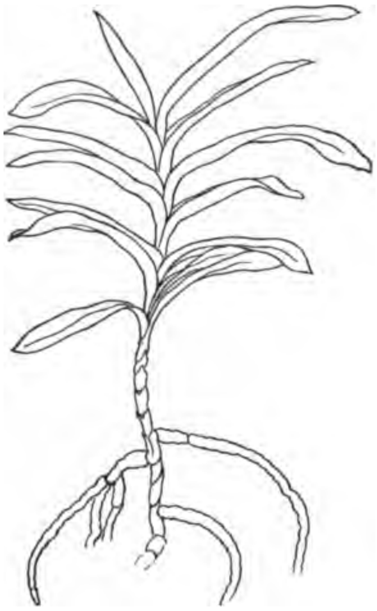
Historical Sketch.—Species of Orchids have long been known to botanists, but the first plants were introduced into hothouses scarcely over a century ago. Plants were sent by missionaries and officers who visited tropical countries. In 1731, *Bletia verecunda* was received in England from the West Indies. In 1789, Commodore Gardner sent plants of *Epidendrum fragrans* from the woods of Jamaica. One of these flowered two years after and was the first Orchid figured in the "Botanical Magazine," plate 152, as *E. cochleatum*. *Phaius grandifolius* had been introduced nine years before and the Vanilla was also known in English conservatories. In 1807 Martyn's edition of Miller's "Gardeners' Dictionary" enumerated 124 Orchids.

At first the wants of these plants were little understood, and many perished from irrational treatment. But as more species were introduced and their natural climatic conditions became better known the plants were treated in accordance with their requirements.



1564. Angræcum sesquipedale. To show very long spur. (×¼.)

The middle part of this century is remarkable for the great number of new and striking kinds of Orchids discovered. Immense sums were paid for single new plants. The fabulous prices paid for novelties caused collectors to scour every part of the tropics, risking their lives in the mountains, jungles and fever-haunted swamps in search of these wondrous plants. At the present time collectors are still engaged in searching the tropics, but striking novelties are rarely introduced. Large quantities of Orchids are annually imported to replenish northern hothouses. It is probable that large sums for single plants have been paid more frequently for Orchids than for any other class of plants. A thousand dollars for a unique plant is perhaps paid less frequently nowadays than in the middle of the century. Nevertheless the interest in Orchids is not declining. On the contrary, the love for Orchids is becoming more widespread. There never has been any distinct Orchid craze followed by a severe reaction, as in the case of the tulip, dahlia, zinnia, camellia, etc., but the interest has gradually extended and is likely always to increase steadily.



1565. Vanda, an example of monopodial growth in Orchids.

Cut-Flowers.—The use of Orchids as cut-flowers is slowly becoming more and more general. Many kinds are easily cultivated with general florists' plants and are thus becoming widespread in cultivation (Cypripedium, Cattleya, Lælia). As yet none of the Orchids can be regarded as florists' flowers in the same sense as roses and carnations. Their use is mostly restricted to special purposes, although they are gaining in popularity. Cattleya, Cypripedium and Dendrobium are, perhaps, the only genera listed in the wholesale market during midwinter. The wonderful keeping qualities of Orchids as cut-flowers are well known. An Orchid flower loses its beauty within a few hours after fertilization.

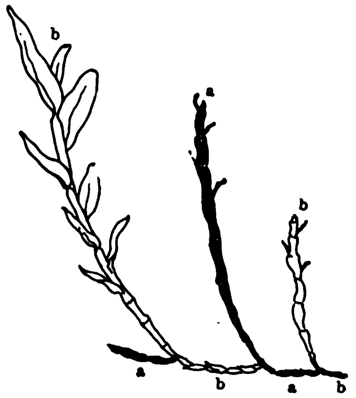
Orchid Hybrids.—One of the most fascinating phases of Orchid culture is the production of hybrids. By crossing of different species and even genera numerous new Orchids have been produced, many of which are superior to the natural species. In some genera the hybrids now far outnumber the original species, notably Læliocattleya.

A large and special literature on Orchids has grown up. Magnificent periodicals, with descriptions and colored plates, have been entirely devoted to Orchids. Notable among these are "Lindenia," Ghent, 1895 and continuing; "Reichenbachia," published by Sander. "The Orchid Album," by R. Warner and B. S. Williams, London, 1882–96; "L'Orchidophile," Paris, 1881–1893, and the "Orchid Review," London, 1893 and continuing, are more popular journals devoted to Orchids. Among the larger monographs are Bateman's "The Orchidaceæ of Mexico and Guatemala," and "A Monograph of Odontoglossum," by the same author. Many plates and descriptions of Orchids occur in the "Botanical Magazine" and in the "Botanical Register." Many of Reichenbach's new species were described in the "Gardener's Chronicle." Among the manuals which have appeared are "A Manual of Orchidaceous Plants Cultivated under Glass in Great Britain," by A. H. Kent, issued in parts by James Veitch and Sons, and "Orchids: Their Culture and Management," by W. Watson. No comprehensive American work has as yet appeared. A list of all known hybrids, however, is given by Geo. Hansen, "The Orchid Hybrids," 1895, including first supplement; second supplement, 1897. This is an American work.

Species in the American Trade.—Orchids are mostly advertised in special catalogues. All the names found in the catalogues of Wm. Mathews (1890), John Saul (1893–6), Pitcher & Manda (1895), and Siebrecht & Wadley are accounted for in this Cyclopedia so far as possible. Some catalogues of European dealers who have American agents—as Sander & Co.—are included. The Mathews collection has fewer species now than in 1890, but it is larger in a general collection of commercial kinds. The collections of Saul and of Pitcher & Manda are dispersed, and many of the rarer and more difficult subjects have doubtless perished. In the nature of the case it is impossible to determine at any given time what species of Orchids are cultivated in America. The great private collections contain many rare kinds imported through foreign dealers. Many species which are known to be cultivated by American amateurs, have been included in this work, although the species are not listed in American catalogues.

PART II. BOTANICAL ACCOUNT OF ORCHIDS.

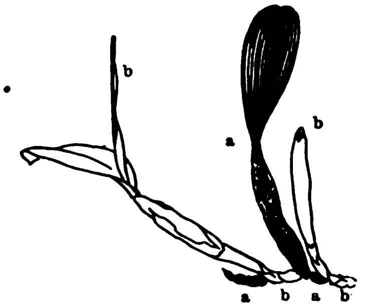
All Orchids are perennial herbs which increase in one of two ways. The simplest form which the vegetative axis may assume is that of a monopodial stem which increases by the continual growth of the terminal bud. Monopodial stems occur in Angræcum, Vanda (Fig. 1565), Phalænopsis, etc. Lateral branches may be formed, but they do not interrupt the growth of the main axis, and never exceed it in length. The growth may be interrupted by a period of rest, but this is not manifested on the stem by the formation of scales, etc. All the leaves are similar. The inflorescence consists of a separate axillary branch bearing bracts and flowers.



1566. Dendrobium; a sympodial Orchid with lateral flower shoots.
The dark and light parts, *a a* and *b b*, represent each the growth of one shoot.

In the greater number of Orchids the terminal bud ceases to grow at the end of the season, either terminating in the inflorescence or blindly. The new growth is continued by an axillary bud originating in the axil of one of the leaves. The whole plant is thus built up of branches sympodially united. The lower part of each new axis is prostrate at first and bears only scales. It is known as the rhizome. Later the apex turns upward and bears ordinary leaves. In many the erect portion of the stem becomes thickened into a food reservoir known as a pseudobulb. The pseudobulb itself may consist of several internodes, as in Lælia, Cattleya. It is then clothed with leaves, at least when young, and bears the scars of the fallen leaves. In other cases only a single internode is thickened. This bears 1 or 2 lvs. at the summit, but has no leaf-scars. The new shoot which continues the growth of the plant arises in the axil of one of the scales below the pseudobulb. The manner of growth is shown in Figs. 1566 and 1567, in which the parts marked *a a* and *b b*, respectively. represent the growth of a branch with its basal portion or rhizome and the terminal portion or pseudobulb. In the terrestrial Orchids pseudobulbs are usually not formed and the erect portion is a long or short stem clothed with leaves (Sobralia, Selenipedium). The inflorescence is either axillary (Dendrobium, Fig. 1566) or terminal (Cattleya, Fig. 1567).

The habit of the plants depends in a great measure upon the rhizome. When this is long the plants are loose and straggling, and when it is short they are compact in habit. In some the rhizome becomes suberect or climbing (species of Lycaste).



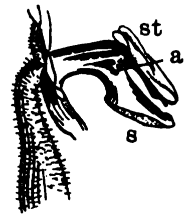
1567. Cattleya.
The light and shaded parts, *a a* and *b b*, each represent one year's growth.

The Orchid flower exhibits perhaps the greatest specialization and adaptation found anywhere in the vegetable kingdom. The 2 outer whorls of floral organs, the sepals and petals, have been sufficiently described.

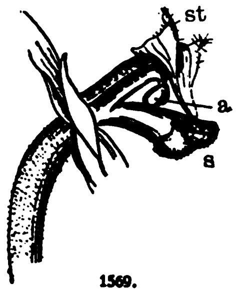
In the monocotyledons there are normally present 2 whorls of stamens. In the Orchids only 1 or 2 of these are fertile. In the Monandræ (Cypripedium, etc.) the odd stamen of the outer whorl is developed into a wing-like staminodium (Figs. 1568, 1569, *st*). The similar stamens of the inner whorl are fertile, and form 2 anthers, 1 on each side of the staminodium (Figs. 1568, 1569, *a*). In all the other Orchids, except in abnormal cases, only the odd stamen of the outer whorl is fertile, bearing an anther situated at the top of the column (Fig. 1570, *a*). The similar two of the inner whorl are developed as staminodia, forming the sides of the clinandrum or anther-bed. Often they are developed into crests or ears on the column. Traces of the other stamens are rarely found in the flower. Compare Figs. 642–644, Vol. I.

The 3 pistils are developed in Cypripedium and a few related genera. In these the stigma is clearly 3-lobed, showing the union of 3 pistils (Figs. 1568, 1569, *s*). In most of the other genera only 2 of the stigmas are receptive, the third being developed into the curious rostellum. In some cases the stigmatic surfaces are confluent into one, while in others they remain more or less distinct. Generally they appear as flat surfaces often sunken in a depression in the column (Læliineæ, Fig. 1570, *s*, and many others). In a few cases the stigmas are more or less elevated on stalks (Habenaria). In Sophronitis they extend partially along two wing-like projections of the column.

The odd pistil, the rostellum, is situated above the stigmas, separating them from the anther-bed. In the Læliineæ its lower surface is still continuous with the stigmatic surface (Figs. 1570, A, B, *r*). The principal function of the rostellum is the secretion of a viscid fluid, by means of which the pollen masses adhere to insects visiting the flowers.



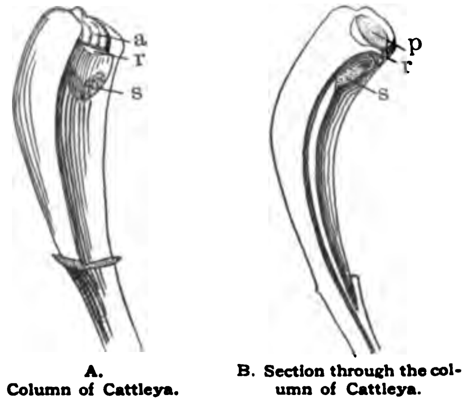
1568. Cypripedium.
***st*, staminodium; *a*, anther; *s*, stigma.**



1569.
Selenipedium caudatum.
***st*, staminodium; *a*, anther; *s*, 3-lobed stigma.**

The anther lies above the rostellum, within a depression or anther-bed (Fig. 1570, *a*). Its cells vary from 2–4 or 8. In nearly all the Orchids the pollen coheres in masses or pollinia (Fig. 1570, *p*), the number of pollen masses corresponding to the number of anther cells. Often the viscid substance uniting the pollen grains is prolonged into a stalk (caudicle), which extends beyond the anther and comes into contact with the viscid substance secreted by the rostellum, which forms an adhesive disk by means of which the pollinia become attached to insects. In many Orchids the outer layer of the rostellum itself separates by a dissolution of the underlying cells, and thus forms a stalk (stipe), which becomes attached to the pollinia by means of the product of the dissolved cells. Whatever its origin, the stalk, with its viscid disk, forms one of the most important parts of the mechanism by means of which pollen is transported from flower to flower, insuring cross-pollination of the group. The details of the mechanism by which this is accomplished have been beautifully explained by Darwin in his classical work, "The Various Contrivances by which Orchids are Fertilized by Insects."

The relation of the parts of the flower to one another is often greatly changed by the peculiar growth of the floral axis. This is convex in the very young stages of development, but it soon becomes cup-like and finally tubular, inclosing the ovary. Special lateral outgrowths near the top of the ovary form the "foot" of the column found in many orchids (Pescatoria, Phaius). When the foot is present the labellum is attached to its apex, and often the sepals are decurrent upon it, forming a men-



A.
Column of Cattleya.
***a*, anther; *r*, rostellum; *s*, stigma**

B. Section through the column of Cattleya.
***p*, pollinium; *r*, rostellum; *s*, stigma**

1570. Details of the column of Cattleya.

tum. In nearly all Orchids the stigmas and anther are carried up by an elongation of the floral axis, to which in this instance the name "column" is applied. In Gongora the petals and dorsal sepal are carried far away from their normal position.

The fruit of Orchids is a dry capsule requiring a long time to ripen, so that if an Orchid is fertilized during one rainy season its seeds are not disseminated until the next wet season. Very few fleshy fruits occur in this family. The seeds are minute and extremely numerous, thus compensating, perhaps, for the uncertainty of fertilization.

The Orchids are distributed over the entire world. They are most numerous in the tropics, becoming rare in the cold zones. They are chiefly collected in three regions, the South American region embracing Mexico, South America and the neighboring islands. Most of the large genera are found in this region (Epidendrum, Pleurothallis, Oncidium, Odontoglossum, etc.). The second region, embracing India and the Malay Islands to Australia, is rich in genera, but most of them are small, containing far less than one hundred species. The largest genus of this region is Dendrobium, with 300 species. The South African region contains few terrestrial Orchids, of which Disa is the only one of importance in cultivation. HEINRICH HASSELBRING.

PART III. THE CULTURE OF ORCHIDS.

Introductory.—During the early days of Orchid culture the treatment of the plants under glass was imperfectly understood, and with the meager knowledge of the natural conditions surrounding them in their native habitats, little successful progress was made for many years. The few cultural directions to be found were in works of foreign publication, scarcely applicable to plants grown in our houses in America, where the winters are severe and changeable and the heat of our summers more intense and less humid, necessitating a different mode of treatment. With a more satisfactory understanding of their requirements during the last 25 or 30 years, Orchid culture here has made a rapid advance and most of our best collections have come into existence, many of which offer a very favorable comparison in fine, well-grown specimens with those of the Old World.

Orchid Houses and Their Construction.—Various are the opinions of cultivators regarding the proper construction of Orchid houses to obtain the best results. Twenty-five or more years ago many fine specimens of Orchids were grown without a special house, along with general stove and greenhouse plants, and we still find many good plants cultivated in this manner, but where a general collection of Orchids is grown four separate houses or divisions will be found necessary to obtain the best results. These are known as the "East Indian," "Brazilian," "Mexican" and "New Granadan," or Odontoglossum departments.

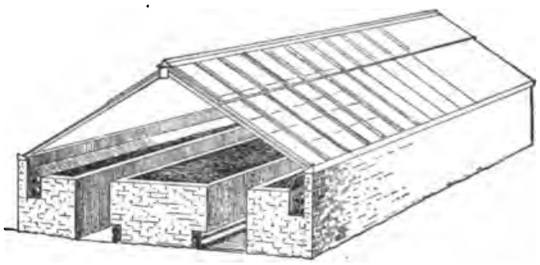
The East Indian department requires a winter temperature of 65° to 70° F. by night and 70° to 75° F. by day; a few degrees' rise with sun heat will do no harm. The temperature should be gradually increased 10 degrees toward midsummer and gradually decreased toward late fall. This is the warmest house and is used for the cultivation of Aërides, Angræcums, the warmer tropical Cypripediums, Phalænopsis, Calanthes, Dendrobiums and Thunias while growing.

The Brazilian department should range during winter from 60° to 65° F. at night and about 70° F. during the day, allowing a few degrees more with solar heat, and a rise of 10 degrees toward midsummer. This department is for Bulbophyllums, Cattleyas, warm Epidendrums, Brazilian Lælias, Miltonias of the cuneata and spectabilis sections, *Odontoglossum citrosmum*, Stanhopeas, and various genera and species requiring a like temperature.

The Mexican department is used chiefly for the cultivation of *Cœlogyne cristata*, Mexican Lælias, growing Lycastes, Anguloas and Acinetas, many species of Maxillaria, a majority of the Oncidiums and warm Odontoglossums, Phaius and allied species which require a few degrees lower night temperature and usually a little more sunlight to ripen their tissue for flowering than is afforded in the Brazilian department. It is also invaluable for resting Dendrobiums and many other deciduous and terrestrial Orchids.

The New Granadan or Odontoglossum department must be kept as cool as possible in summer, and during winter should range from 55° to 60° by night and 60° to 65° F. by day, and as cool as possible during summer; it is used principally for Masdevallias, Odontoglossums, more especially *O. crispum*, and allied genera, Disas, cool Oncidiums, such as *O. ornithorhynchum* and *O. varicosum*, Lycastes in warm weather, and many other individual species from high altitudes which require a cool house at all seasons or they suffer from the heat of our summer.

The fundamental principle in building an Orchid house is to get a structure that can be easily heated and which has a naturally moist atmosphere, without excavating deeply, for houses built much below ground lack circulation and almost always prove detrimental to Orchid culture. The houses (excepting the New Granadan house) should be built to run north and south with an east and west exposure, in order that they may receive the benefit of the early morning and late afternoon sun, with the least possible heating effects from it at noonday, thus making little ventilation necessary; atmospheric moisture will be more easily retained in such a structure. The houses may be as long as required (with the potting-shed at the north end to avoid unnecessary shade and protect the houses in winter against severe north wind), and about 16 ft. wide, which will allow two side beds of 2½ ft. each, two walks of the same width, and a center pit 6 ft. wide. From floor to ridge should be 10 ft. and to the eaves 4½–5 ft. Top ventilators should extend along both sides at ridge, thus affording protection from direct cold winter drafts in airing by using the sheltered side. Side ventilation is unnecessary and often injurious, the direct drafts causing plants which are out of condition to shrivel.

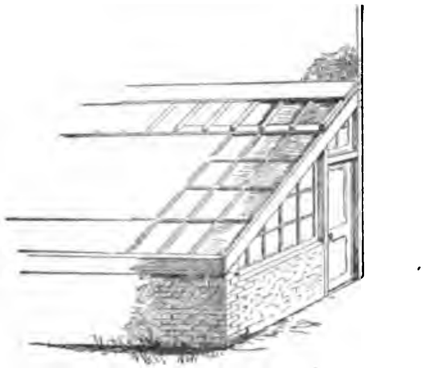


1571. Section of a small, well-constructed Orchid house heated by hot water.

In glazing Orchid houses the glass used should not be less than 12 x 14 in., and larger if possible. It is also important that only the best quality procurable be used, free from lenses which would burn the leaves when shading is removed. Plate glass is much to be preferred when it can be had, as it contains no lenses and gives a pure even light. If this is used a size about 16 x 24 in. will be found very serviceable. Poor glass should not be used in any case, as it necessitates shading long before this is beneficial to the plants.

The outside walls should be built of brick or stone when possible, and the beds and pits within should be of the same material, 8 in. thick and about 3 ft. in height, filled solid to the top, using stone or rubble for drainage in the bottom, following it up with finer material and finishing with an inch or two of fine gravel. Wooden benches may be used if desired, often with first-class results, by covering them 2 or 3 inches deep with ashes, sand or gravel, but the solid benches are more sure to give better satisfaction. They give off moisture more gradually and offer a cool footing for the plant both winter and summer, which is essential and natural.

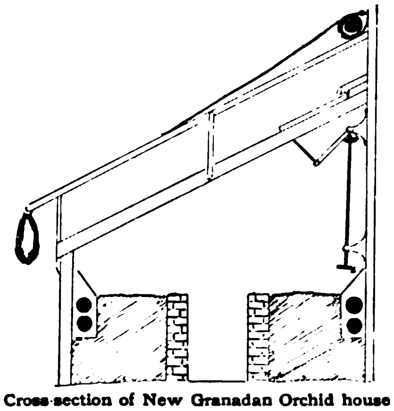
Good results will follow from either steam or hot water heating when both are properly conducted, steam necessitating, perhaps, more care. Unless the range of glass is large and a night fireman is kept, the old-fashioned method of hot water under natural circulation will be found best, using the regulation 3½-inch pipe, running the flows along the back beneath the eaves and returning along the floors beneath. See Fig. 1571, which fairly illustrates a properly constructed house. The quantity of pipe required for heating a house depends upon the location and degree of heat desired. A slab or board should be placed along the back of the side beds to throw the heat against the eaves and protect the plants from direct heat before it has assimilated with the moisture of the house.



1572. Lean-to house with northern aspect for Odontoglossum crispum and other New Granadan Orchids.

The New Granadan house should be a lean-to structure of northern aspect, with a wall of stone or brick along the south side to protect it from solar influence as much as possible (see Fig. 1572). The glass should be protected by canvas roller shades raised 15 or 20 inches above the glass on framework. One side of the canvas should be tacked along the top of the house, and the other to a round wooden roller 3 or 4 inches in diameter and as long as convenient to draw up; the two ropes should be fastened to the ridge, carried down beneath the shade around the roller, and up over the top to a single pulley near the ends; thence through a double pulley in the center and down over the top of the shade to the ground. By these ropes the shade can be raised and lowered in cloudy and bright weather at will (see Fig. 1573). Solid beds and piping similar to the other Orchid houses can be used, or as in Fig. 1571; viz., a flow and return down each side connected with valves so that either or both sides may be used as desired.

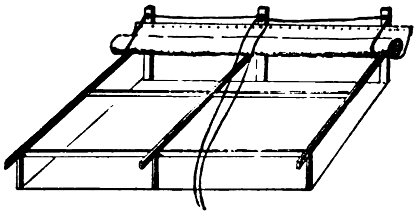
Shading of some sort on the glass is necessary for all Orchid houses from early February until November, and in some cases also during the winter months, to protect the plants from the sun. It may be either of canvas, as in Fig. 1574, or consist of whitewash or paint applied directly to the glass. Whitewash made from fresh lime is perhaps the best to use, as it is easily removed in the fall. The first application in February should be light, following it with a second coat a month later, and, if necessary, a third one in July. This will wear off gradually and in most cases should be entirely removed during December. It is easily removed with a stiff brush. There are also patented shadings.



1573. Cross-section of New Granadan Orchid house to show solid beds and methods of heating and shading.

The Two Great Horticultural Groups.—Orchids are horticulturally divided into two large sections; viz., terrestrial and epiphytal, the former embracing those which grow on the ground and derive their nutriment more or less directly from it; and the latter those which usually attach themselves to rocks and trees, and derive a greater portion of their nutriment from the atmospheric gases and accidental deposit of decaying leaves, or grow among the various ferns and vines, which grow in abundance on the rocks and trees of the moist-wooded tropics, absorbing the various elements of their slowly decomposing humus.

Terrestrial Orchids grow at various altitudes, and are widely distributed throughout both hemispheres, the polar regions and arid deserts excepted. Many are deciduous and tuberous-rooted; some grow from underground rhizomes; others are pseudobulbous and deciduous, while not a few have reed-like stems. Examples of terrestrial Orchids are Catasetum, Calanthe, Cyrtopodium, most Cymbidiums, some of the Cypripediums, Disa, Goodyera, Govenia, Habenaria, Lissochilus, many Masdevallias, Microstylis, Neottia, Orchis, Pogonia, Peristeria, Phaius, Sobralia, Spathoglottis, etc., all of which should be sought under their special genus headings in other portions of this work for cultural directions. They differ very essentially in structure, and in many cases require a special method of treatment for individual plants of the same genus, as Habenaria for example, where some are found growing in rich, turfy loam exposed to sun, while others inhabit wooded, swampy locations.



1574. Method of shading Orchid houses.

Many species of terrestrial Orchids nearly or quite defy successful treatment under cultivation from lack of knowledge regarding the mineralogy of their native habitats, or from the plants being practically saprophytic on certain species of decaying vegetation, or growing only in connection with the mycelium of special fungi, which may assist them in making proper growth.

The hardy species, where a general collection is grown, should be cultivated in pots in coldframes, as many need protection during winter and others require shade which can be supplied by painting the glass. Our native hardy species, however, do best planted out in a properly constructed rockery, laid out in pockets so that each may receive its proper compost.

The more tropical species—Cymbidiums, Cypripediums such as *insigne*, *Phaius grandifolius*, *P. maculatus* and *P. Wallichii*, Sobralias and some other evergreen species—thrive best in the Mexican or cool end of the Brazilian house.

Anæctochilus, tropical Goodyeras and Cypripediums, Spathoglottis, and several genera of like nature, require the same general treatment as epiphytal Orchids, with temperature of the East Indian department at all seasons.

Bletias, Catasetums, Cyrtopodiums, Calanthes, many Lycastes, tropical Liparis and Microstylis, *Phaius Humblotii* and *P. tuberosus*, Thunias and many other deciduous and semi-deciduous species, should be grown in the East Indian, or warm end of the Brazilian department, and during the resting period should be placed in the Mexican department, allowing them only sufficient water to keep the plants in sound condition.

Epiphytal Orchids are found chiefly in the humid forests of tropical countries, often along streams where they receive their condensing moisture during the dry season. A few grow in open grassy situations or among brush. These consist chiefly of climbing Epidendrums of the *E. evectum* section, a few Oncidiums of the caulescent type (the distance between the pseudobulbs often denoting a year's growth), and some of the terete Vandas, etc.

Aërides, Phalænopsis, Vanda and the epiphytal Cypripediums are distributed throughout India, Malay Peninsula, Cochin China, Celebes, Borneo, Philippine Islands, Java and some of the Oceanic islands, usually following the moist forests of mountain ranges, occasionally at high elevations. With one or two exceptions, as *Vanda cærulea*, all do satisfactorily in the East Indian department, reserving the warmest part for Phalænopsis, which as a rule grows nearest the sea-level.

Angræcums are natives of Madagascar and tropical Africa, with one isolated species, *A. falcatum*, which is from Japan. They grow in humid, shady locations, where they can receive a copious supply of water at all seasons, and are closely allied to Vanda, requiring the same general temperature and treatment.

Dendrobiums are most common throughout India, Moulmein being a central district, but they are also plentiful and widely distributed throughout eastern Australia, New Guinea, the islands of the west Pacific and Oceanica under various climatic conditions. A majority of them, especially the deciduous species, are subjected to long droughts and long resting periods, but as they lose their foliage at that time their evaporating surface is reduced to a minimum, and the effect of the dry heat through the day is more than counteracted by heavy dews and the condensing vapors, which arise during the early mornings in those countries.

Bulbophyllums and Cœlogynes have their homes principally in the mountainous forests of East India and Borneo, where they are copiously supplied by frequent rains. Nearly all grow best in the Brazilian department.

Cattleyas and Lælias inhabit the humid forests of the various mountain ranges of tropical America, from Mexico south through the U. S. of Colombia to Peru, the North Amazon valley, through Venezuela and Guiana, and the mountain belt of eastern and southern Brazil, usually at an altitude of 2,000 to 5,000 ft., excepting the Mexican species *L. albida*, *L. anceps*, *L. autumnalis* and *L. majalis*, which grow at from 5,000 to 8,000 feet, commonly among Polypodium fern.

Cattleyas and Lælias grow on rocks and trees often devoid of other vegetation along the margins of rivers and ravines usually in shade, where they receive a copious supply of water from heavy dews and condensation of morning fogs which saturate the forests during the dry season, and often excessive rains while growing. They should be grown in the Brazilian department, excepting *Cattleya citrina*, the Mexican Lælias and *L. Jongheana*, which thrive best in the Mexican department or warm end of the New Granadan house.

Stanhopeas are found from southern Mexico south to Peru, Venezuela, Guiana and Brazil at rather low elevations, often in dense forests, the individual species having a very wide range. The Brazilian house affords them the best temperature, but they may be grown in any of the departments with success.

Epidendrum is a large and varied genus, widely distributed throughout tropical America, from South Carolina to southern Peru, and one of the few epiphytal genera inhabiting the United States. They are found at all elevations from sea-level to 10,000 ft. or more. The writer found *E. Ibaguense* growing in quantity on the margin of perpendicular clay ridges fully exposed to the sun at this altitude in the U. S. of Colombia in a robust, healthy state, and the same species below 5,000 feet in the same condition. Many of the individual species cover a wide range of distribution. They require the same general treatment as Lælias and Cattleyas. Few species are worthy of cultivation except for botanical purposes.

Maxillarias cover much the same range as the last genus, but are not quite so widely distributed. They grow equally well in either the Brazilian or Mexican departments.

Oncidiums are distributed along the mountain ranges from southern Mexico to Peru, in the southern and northern portions of Brazil chiefly along the coast, the Spanish Main and Islands of the Caribbean sea. The *O. Carthaginense* and *Papilio* sections are found at sea-level and seldom above 500 ft. elevation. These grow best in the Brazilian house. Nearly all of the other species may be grown in the Mexican department, except a few, such as *O. cucullatum*, *O. Phalænopsis* and the *O. macranthum* section, which are found at high altitudes; these should be grown in the New Granadan department.

Odontoglossums follow the higher wooded mountain ranges from southern Mexico, Central America and the Central Andes of U. S. of Colombia south to Peru and the northwestern portion of Venezuela, all at high altitudes. They usually grow in the moist shady forests, where the rainy season is long continued or condensing fogs and dews are very heavy, keeping many of the species in an almost perpetual state of saturation, their only relief of excessive moisture appearing to be from the frequent heavy winds that prevail in these regions. The Mexican species grow well in the cool end of the Mexican department, while those of the *O. luteo-purpureum* and *crispum* type require the new Granadan house.

Lycastes are distributed from southern Mexico to Peru along the mountain ranges, usually at an altitude of 4,000 feet in rather shaded locations; they are most common from southern U. S. of Colombia to their northern limit. *L. tetragona* is from southern Brazil and far removed from the general area of distribution, with little resemblance to any other species. Its 4-angled monophyllous pseudobulbs produce semi-pendent scapes carrying often as many as eight flowers, not unlike a Cymbidium in general appearance. Lycastes grow well in either the Mexican or New Granadan department.

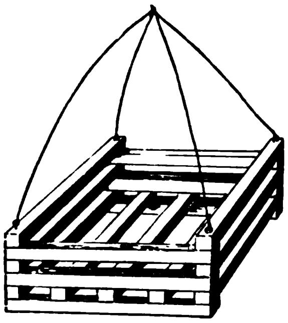
Selenipediums are the South American representatives of Cypripedium. They are distributed from Costa Rica south to Bolivia, through Venezuela, Guiana and eastern Brazil, at from 3,000 to 8,000 ft. elevation, in wet marshes and on the branches of trees in shaded forests, in all cases where they get a bounteous supply of water at all seasons. The Brazilian or Mexican department suits them equally well.

Masdevallias, Restrepias, and Pleurothallis grow at high elevations in Venezuela, Mexico and south to Peru, with a few in the Organ mountains of Brazil, their principal center being U. S. of Colombia near the Odontoglossum district. They always follow the mountain ranges, growing on trees, rocks and on wet, marshy slopes, in extremely wet locations. The Chimæra section is found at the lowest elevation. They all grow best in the New Granadan department.

Newly Imported Orchids.—On arrival of cases of Orchids from their natural habitats they should be carefully unpacked as speedily as possible, in an isolated room where insect pests that often arrive in the cases may be destroyed, and laid carefully and loosely against one another, on the bench of a shady, well-ventilated house or packing-shed. Should they all be found in good condition, the pseudobulbous species, such as Cattleyas and Lælias, should be hosed over thoroughly and allowed to remain for about a week, at the end of which time they should be examined for any signs of decay and bruises. All such parts should be removed with a sharp knife. The plants should be cleaned and sponged to remove dust, potted or basketed, as the case requires, and placed in a shady portion of their respective departments, allowing them sufficient water to gradually start them into action, after which time they will require the same treatment afforded established plants of their kind.

Cypripediums, Masdevallias, Phalænopsis, Vandas, the Batemannia and Bollea sections of Zygopetalum and other non-pseudobulbous genera should be placed on damp sphagnum in a well-shaded, airy department for a week or ten days, without syringing, until it is ascertained what amount of damage they have received in transit. After sponging the leaves carefully and removing any decayed and bruised parts, they may be potted and basketed, and removed to their proper quarters, watering sparingly until they start new action.

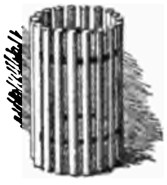
It is customary in some establishments to hang newly imported Orchids by the roots, tops down, from the roof of the house or beneath the benches until they show signs of new action, but they invariably suffer more or less from this practice and are better treated as above.



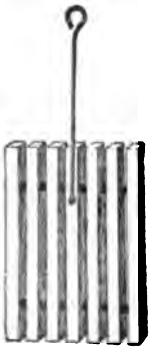
1575. Commonest and best style of basket for general culture of Orchids with pendulous scapes.

Pots, Baskets, etc.—Many Orchids are best cultivated in the ordinary earthen pots and pans, more especially terrestrial species and a few of the epiphytal kinds, which grow on rocks in marshes, and among quantities of humus and fern roots. A majority of the epiphytal species, however, need special structures that will admit air to circulate freely to the roots; otherwise, these are liable to decay through excess of water if confined in close pots when inactive during winter, which must eventually weaken the constitution of the plants.

Figures 1575–1583 fairly illustrate the best and most practical pots and baskets for successful culture. Fig. 1575 shows the Orchid basket most commonly used; it is the best adapted for the general culture of Cattleyas, Coryanthes, Dendrobiums, Epidendrums, Lælias, Masdevallias of the Chimæra section, Oncidiums, and a majority of Orchids with pendulous flower-scapes. They can be made of cedar, teak-wood, cypress, or any durable wood. The wood is cut into square (or round) sticks of any length desirable and in proportionate thickness from ⅛–1 in., and carefully perforated at each end. Through the holes is inserted a strong wire, which is looped at the upper end when finished in order to receive the wire hanger. These baskets can be as deep as desired, but three sticks on each of the four sides are usually enough for most Orchids, with two or three placed crosswise through the bottom, to hold the compost. The hanger is made by twisting together and bending down in the middle two pieces of galvanized or copper wire, forming four ends to insert in the basket-loops and a loop or hook at the top by which to suspend it.



1576. An Orchid cylinder.
Used for very tall species.

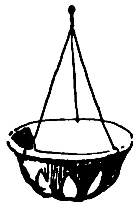


1577.
An Orchid raft.
Used for much the same purpose as the cylinder.

The Orchid cylinder (Fig. 1576) is very useful for standing on the bench or pit, and is used for Renantheras, Aërides, Vandas, Angræcums, Epidendrums, and many other tall plants that are too tall or difficult to suspend. Cylinders are made in all sizes and any diameter desired, with either square or round sticks. They are bored a short distance from the ends and a wire inserted through them, with a small block between each stick, to make an opening for air. When large enough the sides are brought together and fastened. The depth is adjusted by movable cross-pieces.

The Orchid raft (Fig. 1577) is made in much the same way as the cylinder, but is left flat with the openings between closer together. Oblong-square blocks of hard, rough wood, an inch or less thick, answer much the same purpose. The Orchid raft or block is very useful for many species, such as *Cattleya citrina*, Barkerias, *Epidendrum falcatum*, *Dendrobium Jenkinsii*, *Oncidium Limminghii* and *Papilio*, Scuticarias, etc.

The earthen basket (Fig. 1578) is useful when the compost is fine and when the roots do not require much atmospheric action; also to properly mature tissue in a few terrestrial species, thereby inducing them to flower more freely. The earthen basket is especially useful for Acinetas, Peristerias with pendulous scapes, Stanhopeas, etc.; it is made with ovate openings around the sides and a round one in the center to admit pendulous scapes.



1578.
Earthen basket.
For Stanhopeas and other Orchids, whose pendulous scapes issue through the holes in the bottom.

The perforated pan (Fig. 1579) is usually made only in small sizes and used for Bulbophyllums, the concolor type of Cypripedium, Dendrobiums, and many other small-growing species that do well suspended from the roof.

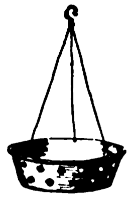
The perforated Orchid pot (Fig. 1580) is for bench use and is useful for many epiphytal Orchids that are not to be suspended, the perforations or holes supplying abundant air to the roots, a safeguard against losing them through overwatering in winter.

Figs. 1581 and 1582 show the standard earthen pot and pan for terrestrial species. They should have the drainage holes made on the side at the base, instead of directly underneath, as a preventive against earth-worms entering from the benches.

Potting, Soil, etc., for Terrestrial Orchids.—Terrestrial Orchids as a general rule grow best under pot culture. Potting material for the following genera—Acanthephippium, Bletia, Calanthe, Cymbidium, *Cypripedium insigne* and most of the hardy species, Cyrtopodium, Habenaria, Liparis, Microstylis, Peristeria, Phaius, Pleione, Sobralia, Thunia, and some others—should consist of about one-third each of chopped sod with some of the fine soil removed, chopped live sphagnum and leaf-mold, adding a little ground bone for some of the strong-growing kinds. One-third of the pot space should be devoted to clean drainage, covered with sphagnum or rough material to keep it open. After removing all decayed portions, the roots should be carefully distributed and the compost worked in gently but firmly around them, leaving the surface a little convex and slightly below the rim of the pot as in Fig. 1581 (the dotted lines denote drainage required). The convex surface gives the rhizome an opportunity to dry out frequently, thus avoiding fungi, which are troublesome to some species.

In repotting terrestrial Orchids sufficient pot room should be given to last a year or two if possible, as they dislike to have their roots disturbed oftener than is necessary. The best time to repot is just before the rooting period, or when they are starting their new growths in spring. The deciduous species of Calanthe can be easily increased at this time, if desired, by removing the old bulbs and placing a number together in a pan or shallow box, covering them partly with compost and placing them in a warm house until they start action, after which time they should be potted as desired, two or three together.

Anœctochilus, Arpophyllums, Cypripediums, Disas, Goodyeras, Spathoglottis, and many allied genera, grow best under pot culture, but otherwise require compost and treatment similar to the epiphytal kinds.



1579.
Perforated pan.
Adapted to small Orchids that do well when suspended from the roof.

Potting, Basketing, and Compost for Epiphytal Orchids.—The roots of epiphytal Orchids are usually very porous, and many are covered with a corky substance (velamen), capable of absorbing and retaining water for considerable time. In their native homes a great many of the roots are aërial or grow in loose, fibrous material, such as moss and the fine roots of Polypodiums and other ferns, where they have free access of air at all times. It is important that they receive similar treatment under cultivation so far as is consistent, with the difference of their environment taken into consideration. Thus it is apparent that one of the special features in the culture of epiphytal Orchids lies in the proper selection of compost and the method of potting and basketing for the best results in after-cultivation.

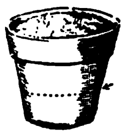
Peat fiber, sphagnum moss and leaf-mold constitute the principal materials of good compost, usually lasting one or two years without renewal, which is important, as the roots suffer more or less in being disturbed. By peat fiber is meant the fibrous roots of various wild ferns, with the fine soil removed by first chopping it into small pieces, then rubbing it across a coarse sieve. The several species of Osmunda furnish us with the best Orchid peat. The sphagnum moss used for Orchids should consist of *Sphagnum squarrosum*, *S. macrophyllum* and the coarse-leaved species only; *S. acutifolium* and other weak-growing species should never be used, as they soon decay and become detrimental to the roots.

1580. Perforated Orchid pot.

Adapted to epiphytes which need plenty of air at the roots and are in danger of over-watering.

Leaf-mold is made from decomposed leaves. The leaves of almost any tree will do, but those of hard-wood trees are most desirable, especially oak. When collected in the fall the leaves should be heaped up to decay for a year or more, and turned over at least twice during that time.

Charcoal is the best material to use for drainage and for mixing or interspersing with the compost. It is best made from hard wood and should not be over-burned. Broken potsherds are often used, but they are not as good; being porous, they either absorb too much water at times or become overdry too often and are liable to prove injurious. Charcoal is lighter in weight, and contains more useful properties.



1581. Standard earthen pot.

For terrestrial Orchids, with drainage holes at the side instead of at the bottom.

Where closed pots are used, nearly one-half of the space should be devoted to drainage and the balance to compost, consisting of about equal parts of peat fiber, chopped sphagnum and leaf-mold for most genera, adding a few pieces of charcoal in potting, and a piece beneath the rhizome of the tender ones. Care must be exercised in potting to distribute the roots properly and make the compost moderately firm about them, leaving the finished surface convex, to throw off surplus water and protect the rhizome from an overabundance of wet. Top dressing with live sphagnum is beneficial to many Orchids, such as *Odontoglossum crispum* and allies, and gives the surface a neat appearance. Fig. 1583 illustrates a finished pot, the dotted line in Fig. 1581 indicating the amount of drainage required.

When perforated or open-work pots or baskets are used, no direct drainage is necessary. Rough, broken pieces of charcoal should be freely used in the compost while potting, as it helps to keep the mass firm and the roots of nearly all species attach to it freely; also it lessens the quantity of compost and so modifies its texture as to allow it to dry out more readily than when packed in a solid body.

1582. Standard earthen pan.

For terrestrial Orchids, showing side drainage holes.

Cattleyas of the *C. intermedia* type, Coryanthes, Cypripediums of the *Lowii* and *Stonei* sections, some Dendrobiums, *Oncidium Carthaginense*, *O. crispum*, *O. macranthum*, *O. Papilio* and their allies should have the leaf-mold omitted, while Aërides, Phalænopsis, Saccolabiums, Vandas and kindred genera require only chopped live sphagnum and charcoal as a compost.

Watering, Humidity.—It is impossible to lay down any hard and fast rules for watering Orchids. Watering is a very important operation and requires more or less practical experience, connected with a knowledge of the general conditions surrounding the plants in their native homes. As a rule most Orchids need a liberal supply while growing, but the condition of the plant and compost and the manner in which it is potted or basketed have much to do with this.

The evergreen terrestrial species, which grow chiefly in loam fiber, as Cymbidium, *Cypripedium insigne*, Phaius, Sobralias, etc., require water whenever the surface of the compost is becoming dry, with occasional light overhead syringing in fine weather, which will assist in keeping down red spider, thrips and other pests. An occasional application of weak liquid cow or sheep manure is of great benefit while the plants are growing.

The deciduous species have a decided period of rest, at which time they are practically inactive and need very little water, enough only to keep the stems and pseudobulbs in sound condition. When growing, however, they require a good supply and should have a thorough watering to the bottom whenever the soil is becoming dry, but should not be kept in a wet condition at all times, or the soil soon becomes sour and infested with worms, under which condition no Orchid can do well.

Epiphytal Orchids, or a greater part of them, in their native habitats grow in locations where heavy rains are frequent or of almost daily occurrence during their growing season, and where condensing vapors settle on them like dripping rain, while the early morning fogs rise among the forests, charging the atmosphere almost to saturation during the early part of the day in the resting season. Such species as are subjected to a severe dry resting season are often deciduous (see *Dendrobium*, and also p. 1166). Many of the extremely alpine species, such as the Masdevallias and *Odontoglossum crispum*, are subjected to two annual rainy seasons, and where these seasons are much prolonged the undersigned has observed the last-mentioned species in its native habitat mature as many as three pseudobulbs in the year. Thus the pseudobulb is no indication of annual growth, but a reservoir of supply in case the plant is overtaken by severe or sudden droughts, each pseudobulb being supplied with a mature secondary bud for further reproduction should the proper lead be destroyed.

1583. Method of potting an epiphytal Orchid.

Showing the raised and round top of sphagnum.

Such genera as Aërides, Cypripediums, Masdevallia, Vanda, etc., which have no pseudobulbs, rely more or less directly on a daily supply at all seasons. These, with many of the extreme alpine species, should have a liberal supply of water at all times.

Many of the pseudobulbous kinds, including Cattleyas and Lælias, are also constantly in action perfecting new roots or maturing their flower-buds, after the pseudobulbs are completed and they are apparently at rest. For this reason careful observation of each species is necessary to make their cultivation successful.

Under basket culture there is least liability of injury through overwatering, and excepting genera like the Oncidiums and Dendrobiums (which need a dry and cool resting period to induce them to flower), and deciduous species at rest, nearly all should receive a good supply of water, weather permitting, whenever the compost is becoming dry, with frequent syringing overhead in fine weather, when the temperature is normal and ventilation can be given. A stimulant of weak sheep or cow manure applied occasionally to plants in action will benefit them.

On cold, cheerless days, when the temperature is below normal and the atmosphere is overcharged with moisture, very little watering or damping is needed, and unless it be some particular species which cannot endure drying, or tiny seedlings, it is safest to withhold water, as at these times the stomata cease action and the plants become overcharged with water; thus those with weak constitutions and immature growths are liable to attacks of wet-spot and rot. The best means of counteraction in such cases is to apply fire heat and ventilation. A close, stagnant atmosphere is always to be avoided.

As a safeguard against excessive changes in humidity a hygrometer should be kept in each department to ascertain and regulate the degrees of moisture, especially during fall and winter. When overabundant, moisture can be reduced by applying fire heat and ventilation, and if insufficient by wetting down the paths and shelves, or pits, and reducing the ventilation. Well regulated departments should be kept as near as possible to 70° or 75° through the day or 80° to 85° with free ventilation, and about 80° at night. Just after damping and watering it will often rise to 85°, but this is of no consequence, as it soon recedes. Orchids at rest, such as Calanthes and Dendrobiums, should be held at 65° to 75°. In no case, where it can be avoided, should it go below 60° nor rise above 90° for any length of time, as serious results are very liable to follow.

Ventilation.—The ventilators should extend the entire length on both sides of the ridge, and be supplied with the best modern lifting apparatus. Extending them continuously along the roof necessitates raising them but a small height to afford proper circulation to the plants and egress of overheated air, without losing too much moisture. Having them on both sides assists in avoiding direct drafts, by using the side protected from the direct wind.

One essential point to be considered is this: When should ventilation be applied so as to be of the most possible benefit to the plants? Air must be given at all times, when possible, to keep the atmosphere active, as well as to lower temperature, also to reduce the density of moisture when excessive in close, inclement weather and during the night. In bright weather ventilate enough to allow egress of the heated air.

It is customary with some cultivators to close down ventilators in wet weather and during the night to help retain heat, etc. This is a serious mistake. It may show no visible injury in bright weather, when the density of moisture in the atmosphere is at a minimum, but this bad practice surely accounts for the decaying of many young growths, which are lost during wet, close and cloudy nights.

Propagation.—Many species of Orchids can be propagated by division and from cuttings. This is usually resorted to when it is desired to increase the stock of rare and unique species and varieties. With the more common species, however, it is cheaper and better to buy freshly imported stock, as it often takes two, three or more years to bring the young plants up to the flowering stage.

The pseudobulbous species, such as Cattleyas, Odontoglossums, Cœlogynes, etc., are propagated by cutting part way through the rhizome three or more pseudobulbs behind the lead with a sharp knife. This will usually retard the sap and force the dormant eye behind the cut to grow. The back portion may then be removed and potted or basketed separately, or left on the plant to mature the new growth, and be removed when it starts action the following season.

With the deciduous Calanthes, the old bulbs should be removed when potting them in spring and put, several together, in pans or flats and partly covered with sphagnum or potting compost until they start to grow, when they should be potted in the regular way. Thunias are easily propagated after the young growths are well advanced, by cutting the last year's stems into pieces 4 or 5 inches long and inserting the ends in chopped sphagnum and sand, placing them in the propagating house until they grow, when they may have their normal heat. Dendrobiums are managed in much the same way, or the old canes can be laid on wet sphagnum, when many will produce new growths from the side eyes on the nodes. Aërides and Vandas are increased by removing the upper portion with a sharp knife, leaving a few roots and at least a foot of stem to each top. The old bases of the stems usually break new growths freely, often producing several new shoots from each. Cypripediums should be divided between the older growths, leaving at least one old growth with each lead, and potted separately, allowing them a little extra moisture until they start to grow. Masdevallias and allied genera can be separated in the same manner, leaving several leaves and one or more new growths or leads to each piece. All species should be propagated at the commencement of the growing season.

Reproduction of Orchids from Seed.—The reproduction of Orchids from seed through crossing and hybridizing has been carried on for many years successfully by a limited number of hybridists, principally abroad, and it is only within the past 10 or 15 years that it has received much attention in America, but in that limit of time very many beautiful hybrids have sprung into cultivation, and to the late firm of Pitcher & Manda, of Short Hills, N. J., much credit is due for the fine work they carried on in this line. Many of our establishments, both private and commercial, are now paying much attention to this branch of Orchid culture, with various degrees of success. The fertilization of Orchids is very easy and requires no special skill, but judgment should be exercised in the selection of proper species for the work, in order that the results may be an improvement over both parents, if possible.

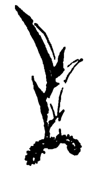
The seed-bearing parent should possess a good, vigorous constitution, of free-growing and flowering habit, as the hybrids usually follow this parent in form of growth, and the pollen parent in color of flower. Fertilization is effected by placing one or more of the pollinia or pollen masses on the stigma of the flower to be fertilized, selecting always plants of relatively the same genus for the operation. Crosses between genera widely removed from each other in general character usually prove fruitless, for though the ovary may become stimulated by foreign pollinia and an apparently successful cross be effected, the seeds will either fail to mature or the results will follow the seed parent in every detail.

It takes about a year to ripen the seed of most Orchids in our climate, with exceptions in a few genera. Masdevallias mature in about six months and Selenipediums in about three months.

The seeds germinate best when sown soon after maturity, and many lose their vitality in a few months if kept too dry and warm. When sowing the seeds the best results are often obtained when they are dusted on the surface of pots or baskets containing a plant of the same genus as the seed and carefully watered with a very fine rose until they become attached, watching carefully for snails, slugs, and depredators in general that infest the compost. The pots or baskets selected should have a favorable-looking surface, with the compost in good condition, firm and free from fungi. Use pots or baskets that will not have to be disturbed for a year or more, as it often takes that length of time for the seedlings to come through. Seed sown in early spring seems to germinate soonest. The writer has had Selenipedium seedlings up in three months from sowing, and again has waited for Cypripedium twenty-three months before the seedlings appeared.

After the seedlings have perfected 2 or 3 leaves it is quite safe to remove them to small pots, singly, or several to a small pan, using compost of the same material as that for the parent, but cut a trifle finer.

1584. Newly germinated seedling. (*Phaius hybridus.*)



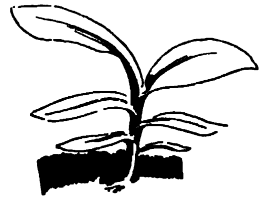
1585. Three months from seed, and ready to transfer to a pot. (*Cypripedium insigne*, var. *Sanderæ.*)

Many tiny seedlings are lost shortly after germinating, through the soil becoming sour or through fungi. When thus attacked they should be transferred to other pots or baskets not infested.

Fig. 1584 illustrates a newly germinated seedling of *Phaius hybridus;* Fig. 1585 a three-months-old seedling of *Cypripedium insigne*, var. *Sanderæ*, in proper condition to be transferred to a pot; Fig. 1586, eight-months-old plant of *Phaius Wallichii;* Fig. 1587 a twelve-months-old hybrid Cattleya (*C. intermedia* × *C. labiata*); Fig. 1588 a Cypripedium thirteen months old; Fig. 1589 a two-year-old hybrid between a Cattleya and Lælia (*C. intermedia* × *L. præstans*).

The raising of Orchids from seed should be encouraged, and enlist the energy of every Orchid culturist, not necessarily for the production of hybrids alone, but also for the reproduction of rare species and varieties, and a number of species which are fast decreasing or becoming extinct in their native homes. Aside from the financial inducement offered the commercial grower, it will prove instructive to the botanist and afford infinite pleasure and pastime for the amateur.

1586. Eight months from seed. (*Phaius Wallichii.*)


1587. A year from the seed. (*Cattleya intermedia* × *C. labiata.*)

1588. Thirteen months from seed. (*Cypripedium.*)

Diseases.—Orchids are subject to many diseases. Those having importance from a cultural standpoint and most troublesome to the grower are known as wet- and dry-rot and spot. Wet-rot is caused by an overmoist or stagnant atmosphere, and is usually first detected by a semi-transparent appearance of the parts affected, which soon become dark brown. It spreads slowly along the tissue. If noticed at the commencement it can be readily checked by slitting the epidermis with a sharp knife and removing the plant to a more airy position in the house for a few days. Dry-rot is caused by a fungus which attacks the rhizome of the plant. It is often produced through burying the rhizome or base of the plant with compost. Cypripediums are subject to it. Large, healthy growths when attacked quickly show a sickly pale color in the foliage, which, on examination of the base, will be found discolored, and with a light brown appearance. If the portion attacked is quickly removed with a sharp knife it will usually give no further trouble; otherwise it will travel through the entire rhizome and destroy the plant in a very short time.

Spot comes from various causes: the appearance of small dark brown spots on the succulent leaves and pseudobulbs is usually an indication of cold and overwatering. Spot also arises through weak tissue, especially in Phalænopsis, Saccolabiums and Angræcums during winter, which have been grown too warm, shady and moist. The affected parts should be slit with a sharp knife and a little flowers of sulfur should be rubbed over the wound. When they make new growth the plants should be placed in a brighter and more airy position to induce a better growth. The brown dots which make their appearance on the leaves, especially at the apices and on new growths of deciduous and plicate-leaved species, indicate either lack of sufficient water at the roots or an overdry atmosphere, both of which conditions can be easily changed.

1589. Two-year-old hybrid between a Cattleya and Lælia.

Snails and Insects.—Orchids are attacked by many forms of snails. Insect pests are a great annoyance to the cultivator. They can be kept in subjection only by constant attention. Slugs and shell snails are very destructive. If allowed to increase they devour young shoots, roots and flower-buds. The best means of capturing them is to place saucers of dry bran on the shelves among the pots, and look them over morning and evening. By this means many will be destroyed. Various species of scale insects attach themselves to the leaves, pseudobulbs and rhizomes of nearly all species of Orchids, and can be eradicated only by the use of a soft brush and washing with a sponge and water. A little whale-oil soap added to the water is of great assistance, and also useful in destroying red spider and green and yellow fly. Black and red thrips attack the young growths of many species and often become very troublesome. Fumigating the houses with tobacco stems lightly about three times during the week will soon cause them to disappear. Fumigation is also a sure remedy for green fly.

The Cattleya fly is very injurious to young growths of Cattleyas, Lælias and some Epidendrums. The flies lay their eggs in the very young growth at the base, causing an enlargement which is easily distinguished. The only remedy is to remove the growth, and burn it. The mature fly can be eradicated by fumigating the house with tobacco stems about three times each week during early spring.

The Dendrobium beetle larva burrows in the stems of various species of the genus, and is detected by a small discolored spot. There is no remedy, except to cut away and destroy the parts attacked. An insect which is much more to be dreaded is the Dendrobium mite, which perforates the canes and rhizomes of Dendrobiums and many other Orchids, laying a number of eggs in each perforation. On hatching, these eat away a part of the plant around them, causing that portion to decay. They can be found only by careful and close observation, and this often after the plant is beyond redemption. There is no remedy but cutting them out, and unless the plant attacked is valuable it is best to burn it and keep the pest from spreading.

Mealy bug is usually not very troublesome to Orchids. It is readily seen and destroyed without much injury to the plant.

Roaches are usually very troublesome, and hard to eradicate, as they feed at night and remain hidden through the daytime. They destroy roots, growing shoots and young flower-buds and scapes. Bran, powdered sugar and Paris green, mixed together and placed around the houses in saucers, will usually keep them in subjection, and they should be hunted down at night by the aid of a lantern. Many can be caught in this manner.

Sow bugs or wood lice are usually common in every part of Orchid houses, pots and baskets. They do a great deal of damage to young leaves, roots and the tender portions of flower-scapes. The Paris green mixture used for roaches is very effectual in reducing their number, but it is impossible to be entirely freed from them.

Robert M. Grey.

ÓRCHIS (Greek word, referring to the shape of the tuberous roots of certain species). *Orchidàceæ.* Orchis is the typical genus of the great family of Orchids. It contains about 70 species, all terrestrial and natives of the northern hemisphere, chiefly in Europe and Asia, with 2 species in North America. Plants perennial by means of simple or palmate tubers: stem simple, erect, terminating in a raceme or spike, with few to many rather small fls., and bearing several lvs., with long sheaths; bracts often foliaceous: sepals all similar, connivent or spreading: petals often smaller, entire: labellum 3-lobed, middle lobe entire or parted, base spurred: column very short or none: stigma plane, not produced (Habenaria).

Orchises are not showy, and they have no horticultural standing, but lovers of our native Orchids are always collecting them and trying to cultivate them, usually with little success. F. W. Barclay writes: "The American species of Orchis are woodland plants, requiring rich leaf soil, with rather heavy shade, and that even condition of moisture characteristic of deep woods. Where these conditions cannot be supplied the plants invariably prove short-lived." See also discussion on terrestrial orchids, page 1165.

hircina, Crantz (*Himantoglóssum hircinum*, Spreng.). Flower stems 1-2 ft. high, bearing a loose raceme 4-8 in. long: fls. greenish white, exhaling a disagreeable odor; middle lobe of the labellum long, strap-like and twisted, lateral lobes much smaller: lvs. few near the bottom of the scape, oblong-lanceolate. May, June. Europe and northern Africa. Advertised by Dutch bulb-growers.

spectábilis, Linn. Fig. 1590. A native species, with 2 large obovate, shining lvs. 4-8 in. long, borne near the ground, and a stem 4-7 in. high, bearing a raceme of 3-6 small pale purple and white fls. April-June. In rich woods, northeastern U. S.

The following species are advertised in America by European dealers, but are not known to be cultivated in America. Most of them are hardy European plants. The synonomy of the group is somewhat confused. *O. Brancifórtii*, fls. purple.—*O. foliòsa*, large, leafy spikes of purple fls.—*O. fúsca*, purple- and rose-colored fls.—*O. latifòlia*, spotted lvs. and purple fls.—*O. longicornis*, fls. rich purple. North Africa.—*O. maculàta*, fls. lilac-purple.—*O. máscula*, fls. purple, in long spikes.—*O. militaris*, fls. purple.—*O. Mòrio*, fls. purple and green.—*O. pállens*, pale sulfur-yellow.—*O. papilionàcea*, fls. purple and white.—*O. provinciàlis*, long spikes of pale lemon-yellow fls.—*O. Robertiàna*, fls. purple, brown and white, in large spikes.—*O. sambucìna*, fls. yellow.—*O. undulatifòlia*, fls. white- and rose-colored.

HEINRICH HASSELBRING.

ORCHIS, Rein. *Habenaria.*

OREGON, HORTICULTURE IN. Fig. 1591. Oregon, located between 42° and 46° 15′ N. and 116° 45′ and 124° 30′ W., with an area of 94,560 square miles, has, horticulturally speaking, four quite distinct districts,—the valleys of the Rogue, Umpqua, Willamette and Columbia rivers, together with their tributaries. There is climatically a very wide difference between these various sections. In the Rogue river valley the annual rainfall is 20-35 inches. The mean temperature for the winter months is 39°, spring months 57°, the summer months 67°, the autumn months 52°. The Umpqua valley has a rainfall of 22-43 inches. The average temperature for the seasons in the same order as the above is, 41°, 51°, 65°, 54°. In the Willamette valley the rainfall is 35-50 inches, the average temperature, 41°, 50°, 63°, 53°. In the Columbia valley it ranges from an average rainfall of 75 inches, in the lower part, to one of 15 inches in the upper part; and the temperature as above ranges from a mean annual average of 50°, varying from 39°-61° for the lower part, to one of 48° for the upper part, with hot summer months and cold winter months.

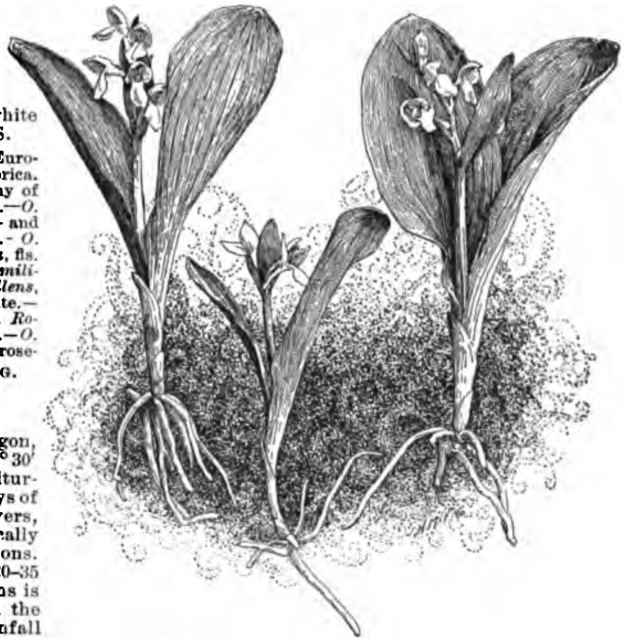
Not only does the difference of climate exist, but there is also a corresponding difference in the character of the soils of these different localities. In the Rogue river valley the soil is largely one of decomposed granite. A warm and open soil predominates, though in places the soil is remarkably heavy and of the same origin as a large part of the soils of the state, namely, basaltic. In the Umpqua valley the soil is generally of a medium character; clays predominate on the hills and on the higher parts of the valley proper, while on the river bottoms sand and open sedimentary soils are the more common. In the Willamette valley the soils are generally heavy, though there are occasionally streaks of light sandy or gravelly soil, usually along the streams. The soils of the Columbia region embrace all grades, from the light drifting sand of its upper basin to the cold clays of its lower basin.

The transportation facilities are good in all these districts, except the Rogue and Umpqua valleys, which have only one railroad; while the other sections, except the extreme eastern portion of the Columbia basin, have both railroads and river transportation facilities.

In all these districts the hardy fruits grow to perfection one year with another, and this without irrigation, though in some of the newer territory being tested for horticultural purposes irrigation is practiced.

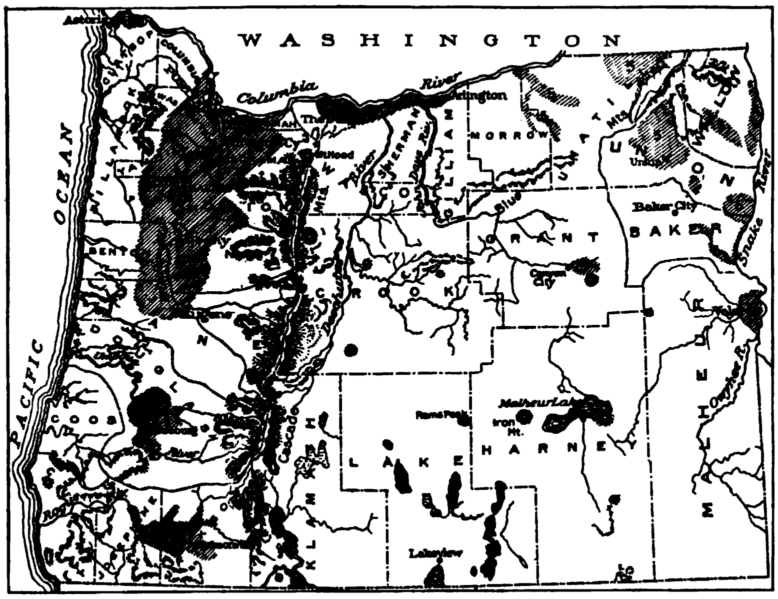
The apple finds in Oregon a most congenial home, and while only a small part of the crop is marketed it is in no wise due to the climate and soil. Our best varieties are Baldwin, Esopus Spitzenberg, Ben Davis, Newtown Pippin, Red Cheek Pippin, York Imperial, and Jonathan. The apple thrives best in the higher altitudes and especially in Hood river valley, an offshoot of the Columbia river valley, and in the Rogue river valley. Lately car lots have been shipped from the hitherto little known sections of eastern Oregon.

Pears grow to perfection in all parts of the state. The Bartlett, White Doyenne, Winter Nelis, Duchesse d'Angouleme, Easter and Clairgeau are the leading varieties.


1590. Orchis spectabilis (× ½).

The peach grows vigorously and fruits in the more favored portion of all districts, i. e., sheltered places along the river bottoms. But in the Rogue river valley, and to a limited extent in upper Columbia valley, it is grown as a commercial crop. Large quantities of the choicest fruits are shipped to the Willamette valley towns, two hundred and fifty or more miles by rail. The leading varieties are early and late Crawfords and Salway. In the upper Columbia region the Crawfords and Salway are favorites.

The cherry reaches perfection in Oregon's mild, moist climate, and especially the sweet cherries. Such varieties as the Napoleon, locally known as Royal Ann; Lewelling, locally known as Black Republican, and several local seedlings, as the Lambert, Hoskins, Occident and Lake, develop into the choicest of fruits. The Late Duke, Late Kentish, Richmond and Montmorency Ordinary, in fact all cherries, do well, though these latter are of no particular commercial importance.



1591. Oregon, showing, by the shaded areas, the horticultural regions.

The plums, and especially those varieties of *Prunus domestica* which have come into general cultivation in the more favorable sections of the country, thrive throughout the state, though there are particular localities where those varieties cultivated as prunes do much better than in others. As a commercial crop the prune has become of much importance to the state, the output for 1898 on a conservative basis being put at 400 car-loads of 30,000 pounds each and valued at 3¼ and 3⅛ cents per pound. For green fruit for local market the Yellow Egg, Peach, Columbia and Bradshaw are grown. Several attempts have been made to ship the Peach variety in a fresh state to the East, but thus far all such efforts have ended in failure. It will not keep long enough and stand up under the jar of transportation. For the prune crop two varieties are grown, the Italian and the Agen, locally known as the French or Petite. At present there is a much larger acreage of Italians than of Petites. There is a limited acreage of Golden Drop, locally known as Silver Prune, but as the tree is not robust, and as the fruit needs sulfuring before it is cured, this variety is given much less attention now than formerly, and only a limited quantity is grown. The curing of the prune is all done by means of driers or evaporators, of which there are numerous designs. (See *Evaporating of Fruits.*)

Of small fruits it may be said that they grow and fruit most abundantly in all parts of the state. Only about the larger cities are they grown as commercial crops, though at Hood river, which is a favored locality, large quantities of strawberries (the Clarke variety) are grown. In 1898 about fifty car-loads of these berries were shipped to the Rocky mountain states, returning to the growers something like $37,000. Blackberries, gooseberries, strawberries and raspberries do well in nearly all localities. Usually it is necessary to select favored sites for blackberries and strawberries: the former on account of water, our long, dry summers being uncongenial; the latter, on account of our heavy soils, will not generally do best on other than river bottoms or sandy ravines. Of currants the chief varieties are Cherry, Fay, White Grape and Black Naples; of blackberries the chief varieties are Lawton, Kittatinny, Erie; of the dewberry, Lucretia; of raspberries, Cuthbert, Gregg, Red Antwerp and Marlboro; of strawberries, Wilson, Sharpless, Clarke, Magoon and Everbearing; of gooseberries, Champion, Downing and Chautauqua. The wine grape is grown in southern Oregon and particular localities along the Columbia river, but the output can hardly be said to have commercial significance as yet, though it is rated as of excellent quality. During the past few years some large plantings of wine grapes have been made in the Rogue river valley.

In the Willamette valley the Moore Diamond, Concord, Worden, Delaware and Isabella are the most generally grown. Along the Columbia, the Sweetwater, the Muscats and Tokays are considered best. In southern Oregon both the American and foreign grapes flourish. The Mission grape of California, Sweetwater, Hamburg and Muscats fully mature in this section.

Chestnuts of the American and Japan varieties have been planted in numerous localities, and are just beginning to bear fine crops. French walnuts and filberts are likewise grown in many localities by amateurs, and much interest is being manifested in this fruit and in the near future commercial plantings will undoubtedly be made. From the experience of the past and the character of the nuts produced, it is confidently predicted that the nut crop of the future will be one of much value on the foothill land of the state. The almond, the apricot, the black fig and the loquat grow and fruit quite freely in the southern sections of the state. The cranberry thrives along the coast, and there are a few small bogs under cultivation in favorite spots.

E. R. LAKE.

OREÓCOME. See *Selinum*.

OREODÓXA (Greek, *mountain glory*). *Palmàceæ*. This genus includes the Royal Palm, the pride of Florida, and the only tall palm native within the borders of the United States before the annexation of Porto Rico and Hawaii; also the Cabbage Palm, which is cut down when three years old for the central leaves, which are tender and edible. Oreodoxa contains 5 species of pinnate palms from tropical America. The nearest cultivated allies are Euterpe and Acanthophœnix, but in these the petals of the pistillate fls. are free, while in Oreodoxa they are grown together at the base. Oreodoxas are spineless palms, the solitary, erect, robust trunk cylindrical or swollen at the middle: lvs. terminal, equally pinnatisect; segments narrowly linear-lanceolate, narrowed at the apex, unequally bifid; midnerve rather thick, scaly beneath; margins not thickened, recurved at the base; rachis convex on the back, sulcate toward the base, and acute toward the apex above; petiole half-cylindrical, sulcate above: sheath long: spadix rather large, with long, slender, pendent branches: spathes 2, entire, the lower semi-cylindrical, equaling the spadix, the upper ensiform, ventrally fissured: bracts and bractlets scaly: fls. small, white, in scattered glomerules: fr. obovoid or oblong-ovoid, small, violet.

Of the Royal Palm Reasoner writes: "It is one of the grandest of pinnate palms, growing to a height of over 100 ft., with immense, plumy, feathery leaves and a straight white trunk. It is a grand tree for extreme S. Fla. for avenue planting, and is valuable in all sizes, but especially when 4 ft. or over in height."

A. *Leaf-segments not wrinkled or wavy.*

B. *Trunk swollen at or above the middle.*

règia, HBK. ROYAL PALM. Fig. 1592. Caudex 40–60 ft. high: leaf segments 2½ ft. long, 1 in. or less wide, linear, acuminate: fr. ovoid, ½ in. Everglades of Fla., Cuba, Antigua. G.F. 9:155. S.S. 10:505. G.C. III. 17:239; 27:297. A.F. 12:311. G.M. supp. Oct. 1, 1892.

BB. *Trunk not swollen at the middle.*

oleràcea, Mart. (*Arèca oleràcea*, Jacq.). CABBAGE PALM. Caudex 100–120 ft. high: leaf-segments lanceolate-linear, acuminate, 3 ft. long, 1½ in. wide: fruit obovoid-oblong, ¾ in. West Indies. Cult. in S. Fla.

AA. *Leaf-segments wrinkled and wavy.*

Sancòna, HBK. Stem 120–150 ft., smooth, glabrous, grayish black: lvs. pinnate; lfts. membranaceous: wood very hard, used in building houses. Colombia. Cult. only in S. Calif.—Franceschi says it has brownish leaf-stalks and is more tender than the other 2 species.

JARED G. SMITH.

OREOPÀNAX (i.e., *mountain Panax*). *Araliàceæ.* Some eighty species names have been referred to this genus, but the number of species is probably not one-half this number. In the trade, the species of Oreopanax are usually known as Aralias, but in the Aralia tribe the petals are imbricate in the bud, whereas in Oreopanax they are valvate. The Oreopanaxes are tropical American trees and shrubs, with simple or compound entire or toothed thick lvs., and fls. in dense heads which are arranged in racemes or panicles: calyx with minute or obsolete limb: petals 4–7, usually 5, the stamens of the same number and with ovate or oblong anthers: ovary 3–7-loculed, the styles rather long and bearing a flat, not thick, stigma: fr. globose and berry-like. Few species of Oreopanax are known in cultivation. They are hothouse subjects, requiring the treatment given tropical Aralias. Harms (Engler & Prantl, Pflanzenfamilien) divides the species into 3 groups,—lvs. digitate, lvs. lobed, lvs. not lobed. The species described beyond are those which are now most often mentioned in gardening literature, but the writer has seen only the first in American collections.

1592. Royal Palm, Oreodoxa regia.

A. *Lvs. all simple.*

reticulàtum, Decne. & Planch. (*Aràlia reticulàta*, Willd.). Fig. 1593. Small tree, with alternate, thick, entire, oblanceolate lvs. 12–18 in. long, somewhat revolute on the margin, strongly alternate-veined and reticulated with shades of green: fl.-heads spherical, nearly or quite an inch in diam. S. Amer.—A handsome plant for foliage.

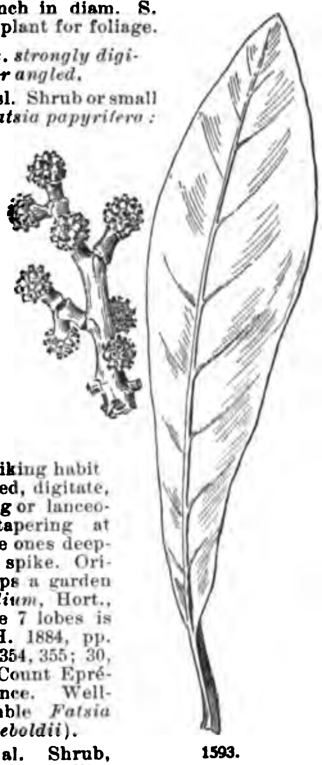
AA. *Some of the lvs. strongly digitately lobed or angled.*

Sanderiànum, Hemsl. Shrub or small tree, with habit of *Fatsia papyrifera*: lvs. glabrous, thick and glossy, long-stalked, triangular-ovate in outline, on young shoots deeply 3-lobed but on flowering plants cordate and entire: fls. minute, in small, globose heads, which are arranged in racemose panicles. Guatemala. G.C. III. 13:451. A. F. 8:1283.

AAA. *Some or all of the lvs. digitate.*

Epremesniliànum, André. Shrub of striking habit lvs. large, long-stalked, digitate, the leaflets 7–9, oblong or lanceolate and usually tapering at either end, the middle ones deep-lobed: fl.-heads in a spike. Origin unknown; perhaps a garden form of *O. dactylifolium*, Hort., in which each of the 7 lobes is usually lobed. R. H. 1884, pp. 320, 321. Gn. 29, pp. 354, 355; 30, p. 447.—Named for Count Eprémesnil, Dieppe, France. Well-grown plants resemble *Fatsia Japonica* (*Aralia Sieboldii*).

Andreànum, Marchal. Shrub, with variable foliage: lvs. elliptic to roundish, stalked, the lower surface and petioles red-tomentose, varying from angled to deeply digitate and the divisions pinnatifid: fl.-heads globular, in a terminal raceme. Ecuador. R.H. 1882, pp. 524, 525.



1593. Oreopanax reticulatum. (× ¼.)

Thibaùtii, Hook. Small tree, stellate-pubescent on the young parts: lvs. long-stalked, 5-7-foliolate, the leaflets lanceolate or oblanceolate, entire, 6 in. or less long, dark green: fl.-heads ⅓ in. in diam., in a terminal raceme 1 ft. long. Mex. B.M. 6340.

pedunculàtum was once listed in Calif., with following description: "lvs. palmate, tinged with red; makes a fine foliage plant. Guatemala." It turns out to be *Kœlreuteria paniculata.*

L. H. B.

ORÍGANUM (ancient Greek name said to mean *delight of mountains*). *Labiàtæ.* This includes several plants known as Marjoram which are fully described below from the popular and horticultural points of view. Botanically these plants are closely allied to the thyme, but the fls. of Marjoram are borne in heads surrounded by an involucre, while those of thyme are borne in few-fld. whorls which are axillary or spicate above.

Origanum is a genus of about 25 species of subshrubs and herbs mostly natives of the Mediterranean region. Whorls 2-fld., rarely 6–10-fld., crowded into globose or oblong spikelets: bracts colored and larger than the calyx, or green and smaller than the calyx; calyx various, 5-toothed or 2-lipped: corolla 2-lipped.

Authorities differ as to whether the common Pot Marjoram is *O. vulgare* or *O. Onites;* Vilmorin's Vegetable Garden holding to the first opinion, while Nicholson's Dictionary of Gardening and J. M. Thorburn & Co. take the latter. The two plants are very distinct, as the following descriptions show, and the point can be easily settled by each reader for the particular plants which he is cultivating.

A. *Calyx of 5 equal teeth: bracts colored.*

vulgàre, Linn. WILD MARJORAM. Lvs. stalked, broadly ovate, subserrate, broadly rounded at the base, villous: fls. purplish, in corymbed clusters or short spikes.—Cult. in old gardens; also wild along eastern roadsides, being naturalized from Eu. B.B. 3:111.

AA. *Calyx 2-lipped: bracts not colored.*

B. *Lvs. stalked.*

Majoràna, Linn. Lvs. oblong-ovate, entire, tomentose: fls. purplish or whitish: spikelets oblong, 3–5 in a cluster.

BB. *Lvs. not stalked.*

Onites, Linn. Lvs. ovate, subserrate, villous or tomentose, mostly cordate at the base: fls. as in *O. Majorana* but a little larger: spikelets ovoid, very numerous in a cluster. Southeastern Eu., Asia Minor, Syria.

W. M.

Origanum Majorana, Sweet or Annual Marjoram. is a native of the countries bordering the Mediterranean sea. It is an erect, branching perennial, bearing grayish green, rounded or oval leaves, small, whitish flowers in terminal clusters which appear in midsummer, and little, oval, dark brown seeds. The plant has a pleasing odor and warm, aromatic, bitterish taste, due to a volatile oil which is soluble in water, is officinally credited with tonic and gently excitant properties, and, as an infusion, is employed in domestic medicine to "bring out the rash" in such diseases as measles. More frequently than in medicine, however, its green parts are used as a condiment, being highly esteemed as a seasoning for soups, stews, meat pies and dressings. In the garden this plant is treated as an annual, hence the name "Annual Marjoram." This practice became necessary since the plants are prone to winter-kill unless carefully protected. Its propagation is also somewhat precarious, owing to the small size of the seeds and the tenderness of the seedlings when exposed to the sun. Shade, therefore, until the plants are well rooted is usually necessary. Successional plantings may be made throughout the spring; sometimes transplanting from hotbeds or coldframes in May or June is practiced. The plants should stand 6 inches asunder in rows 12 inches apart, in light, dry, but good soil, be kept clean throughout the season, and harvested for winter use just before flowering, the plant being cut close to the ground and hung in a cool, airy place to dry. If planted early, leaves may be gathered in late spring. According to Dreer, American-grown seed is better than imported seed for winter use, as it makes more bulk, while imported seed is better when the plants are to be cut green for summer use.

Origanum vulgare, Pot Marjoram, a branching, hardy perennial, about 2 feet tall, bearing in midsummer pink or purple flowers, and small, brown, oval seeds, grows wild on the skirts of European woods. The highly aromatic leaves and the young shoots gathered just before blossoming are used like those of Sweet Marjoram. The plant is of easy culture, succeeding in all warm garden soils. It may be propagated by seed, but, where established, division in spring or early autumn is generally practiced. The plants should be set 10 inches asunder in rows 15 inches apart, and kept well cultivated. Dwarf Pot Marjoram, a variety that comes true from seed, bears large heads of whitish flowers, and is often used as an edging plant.

M. G. KAINS.

ORÍXA (Japanese name). *Rutàceæ*. Deciduous shrub, with alternate, petioled, almost entire lvs., and greenish inconspicuous fls. It has proved hardy in Mass., but has no decorative merit besides its bright green foliage, which is not attacked by insects or fungi, and has a strong disagreeable odor like that of Ptelea. Orixa seems to grow in almost any soil. Propagated by greenwood cuttings; also by layers and root cuttings and by seeds. The genus has but one species. Fls. diœcious, appearing with the lvs. on the branches of the previous year; sepals and petals 4, staminate fls. in racemes, pistillate fls. solitary: fr. consisting of 4 dehiscent pods, each containing 1 black, subglobose seed. Pistillate fls. and fr. are described as solitary as stated above, and so they are on Japanese specimens, but a plant in the Arnold Arboretum has the pistillate fls. and fr. in short racemes.

Japónica, Thunb. (*Celástrus Oríxa*, Sieb. & Zucc. *Ilex Oríxa*, Spreng. *Othèra Oríxa*, Lam.). Shrub, to 8 ft., with spreading branches pubescent when young: lvs. obovate to oblong, obtusely pointed, entire or finely crenulate, bright green above, finely pubescent beneath, translucently glandular-punctate, 2–4 in. long: fls. small, greenish: pods about ⅛ in. long, light greenish brown. April, May. Japan. Gt. 35:1232.

ALFRED REHDER.

ORNAMENTAL GARDENING, or ornamental horticulture, is that branch of horticulture which is concerned with cultivating plants of all kinds for ornament rather than for food. It includes floriculture and also the culture of trees for shade and display. (The culture of trees on a large scale for timber and for other profitable purposes aside from ornament is forestry. The culture of trees in general is arboriculture.) Ornamental gardening includes carpet-bedding and formal gardening in general, while landscape gardening is concerned with making nature-like pictures, or at least with the general plan of the place.

ORNITHÓGALUM (Greek, *bird* and *milk*; application unknown). *Liliàceæ*. This genus includes the Star of Bethlehem, a dwarf, hardy bulbous plant which bears umbels of green and white fls. in May and June. Ornithogalum is one of the largest genera in the lily family, containing about 100 species scattered over Europe, the Orient, North and South Africa. In 1873, when Baker monographed the genus (in Latin) in the Journal of the Linnean Society, he recognized 73 species altogether, but in 1897 he gives an account (in English) in Flora Capensis of an equal number from South Africa alone. Baker made 7 subgenera, based chiefly upon the color of the fls. and the shape of the cluster, though one subgenus was cut off from all the rest by having the stamens perigynous instead of hypogynous. The majority of the species seem to have more or less green in the fls. either on the face or back or both, and often the green is prettily set off by a narrow white margin. Some species have pure white fls. and a few have yellow or yellowish ones. Some of the dominant forms of flower-clusters are oblong-cylindrical, broadly triangular, subcorymbose and lanceolate. Ornithogalum is distinguished from other genera as follows: perianth persistent; tube none; segments 6, usually spreading: filaments more or less flattened and in many species unequal; alternate ones being broader at the base: ovary sessile, 3-celled; ovules many in a cell, superposed: style short or long: capsule membranous, loculicidally 3-valved: seeds globose, usually not crowded nor compressed: often the perianth segments are keeled and the green color follows the keel.

Horticulturally, Ornithogalums may be divided into hardy and tender groups, and each of these may be subdivided into dwarf and tall. The hardy kinds are considered by English amateurs amongst the choicest summer-blooming bulbs for wild gardening. With the remarkable increase of wild gardens now going on in America, arrangements should be made so that amateurs may procure these bulbs cheaply and scatter them with a free hand along woodland walks and in the grass. The common Star of Bethlehem, *O. umbellatum*, a dwarf kind, is the only Ornithogalum that is at all common in our gardens. *O. nutans* has escaped from a few old gardens but seems never to be advertised in America, and rarely even by the Dutch bulb-growers, but in England "it is a very popular species and one of the most easily managed of all the Ornithogalums. In borders amongst other named bulbs, however, it becomes a great nuisance, an account of the freedom with which its innumerable bulbils are formed. In a semi-wild or uncultivated spot it is a capital subject for groundwork; it requires no attention whatever, and flowers freely all through April and May."

Of the taller hardy kinds *O. latifolium* and *O. pyra-*

midale seem to be the most desirable. These are the best to place among shrubbery and leave undisturbed for years. A particularly robust clump of *O. latifolium* is recorded as bearing over a hundred spikes of flowers on stalks 3 ft. high. *O. pyramidale* is here doubtfully referred to *O. Narbonense*, but there is no doubt about the beauty of the plant which English gardeners call *O. pyramidale*. For formal beauty it is hard to excel. It sometimes makes a perfect pyramid of starry white flowers, the spike 12–18 in. long, the fls. an inch across, and a hundred or more fls. in a spike.

The tender kinds in cultivation are chiefly from the Cape of Good Hope, though *O. Arabicum* is found in the Mediterranean region. Connoisseurs are divided between *O. Arabicum* and *O. revolutum*, but the former has been more pictured and has a greater number of admirers. When well grown it is probably the showiest plant of the whole genus. *O. Arabicum* is a fickle plant. It grows to perfection in Guernsey, with stalks 3 ft. high and fls. 2 in. across, borne in free, informal clusters. The tall-spiked waving masses of white remain in good condition for some weeks. In Guernsey they are esteemed for cut-flowers. The white of the large, broad-petaled fls. is set off by a gleaming black pistil, which makes a striking and pretty feature. *O. Arabicum* is suitable for pot culture in northern conservatories, but perhaps the best way to grow it is in quantity in a frame. The bulbs have a way of remaining dormant for a season or two, a difficulty possibly to be associated with their insufficient ripening. W. Goldring writes: "To keep the pots with the bulbs in them in a greenhouse and not watered is not sufficient; they should be kept in a dry atmosphere, and if baked in the sun, so much the better. Autumn is the best time to get bulbs, and after potting they should be kept dry till spring, and with the signs of growth plenty of water should be given, and occasional weak manure water." It is suspected that there are two varieties, a shy-blooming and a free-blooming kind. This may explain some of its reputation for capriciousness. *O. thyrsoides* is easier to grow and earlier to bloom. With gentle forcing it may be had for Christmas in a moderately warm house. *O. revolutum* is very distinct by having revolute instead of spreading segments. It was cult. by a Cincinnati amateur in 1883, but to-day one may search a dozen of the largest bulb catalogues without finding it offered. *O. caudatum* is similarly rare in trade catalogues, but it is still cultivated in dwelling houses under the erroneous name of Sea Onion. The Sea Onion is *Urginea maritima*, a plant of the same general appearance but distinguishable in leaf, flower and fruit as follows: *Urginea maritima* has lvs. 2–3 in. wide: raceme 1½–2 ft long: bracts 3–4 lines long: fls. white with a brown keel: seeds crowded, disk-like. *Ornithogalum caudatum* has lvs. 1–1½ in. wide; raceme ½–1 ft. long: bracts 6–9 lines long: fls. keeled with green: seeds not crowded nor compressed.

Perhaps the best purely horticultural reviews of this group are to be found in The Garden: the tender kinds by Goldring in Gn. 49, p. 308; the hardy kinds by "D.K." in Gn. 41, p. 376.

A. *Fls. self-colored, both front and back.*

B. *Pistil prominent, shining, greenish black.*

Aràbicum, Linn. Fig. 1594. Bulb ovoid, 1–1½ in. thick, proliferous: lvs. 5–8, glaucous green, 1–1½ ft. long, ¾–1 in. wide: scape 1–2 ft. long: raceme 6–12-fld., roundish or deltoid in outline, 3–5 in. long and wide: fls. self-colored, odorous; filaments lanceolate, not cuspidate, alternate ones distinctly broader, but not quadrangular on the base. Mediterranean region. B.M. 728. Gn. 49:1063 (good). B.M. 3179 and B.R. 11:906 (as *O. corymbosum*). G.C. II. 19:665. Gn. 22, p. 249; 32, p. 145; 41, p. 377; 48, p. 309.—The pistil is a beautiful and striking feature.

BB. *Pistil not a striking feature, dull, smaller.*

C. *Number of flowers in a cluster 12–30.*

thyrsoìdes, Jacq. Bulb globose, 1½–2 in. thick: lvs. 5–6, lanceolate, 6–12 in. long, 1–2 in. wide: scape ½–1½ ft. high: raceme 12–30-fld., dense, triangular in outline, 3–4 in. wide: fls. self-colored; filaments alternately longer and lanceolate, alternately shorter, dilated above the base and bicuspidate. S. Afr. B.M. 1164 (fls. white, with a brown eye).

Var. **aùreum**, Ait. (*O. aùreum*, Curt.), has golden yellow fls. B.M. 190 (fls. saffron).

Var. **flavéscens**, Ker., has pale yellow fls. B.R. 4:305.

CC. *Number of flowers in a cluster 50–100.*

latifòlium, Linn. Lvs. 5–6, ascending, glabrous, fleshy herbaceous, broadly lorate, 12–15 in. long, 1½–2 in. wide in cult.: filaments about equal, lanceolate. Tauria, Caucasus, Kurdistan, Arabia, Egypt. B.M. 876. B.R. 23:1978 (fls. green only at tip of keel, and borne in a perfect pyramid).

AA. *Fls. with a green face, the outer segments narrowly margined white.*

B. *Cluster inversely pyramidal in outline.*

tenuifòlium, Guss. Bulb ovoid, 1 in. thick, simple: lvs. 5–6, narrowly linear, 5–6 in. long, 1–2 lines wide, unspotted: scape 2–3 in. long: raceme 6–10-fld., corymbose or inversely triangular in outline, 2–3 in. long and wide: pedicels ascending: fls. with outer perianth segments margined white. Mediterranean region.

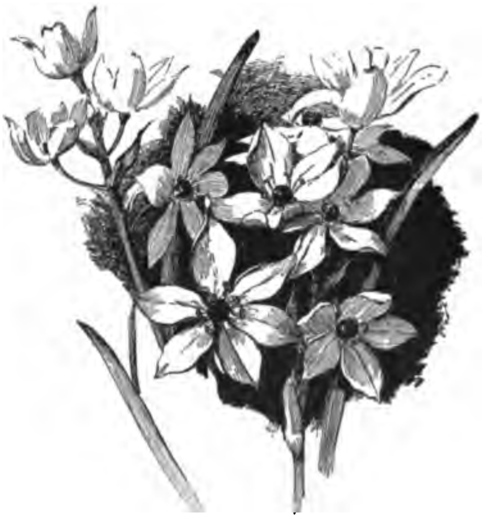
BB. *Clusters quadrangular in outline.*

C. *Number of flowers 12–20.*

umbellàtum, Linn. STAR OF BETHLEHEM. Bulb subglobose, 1 in. thick, bearing numerous bulbils: lvs. 6–9, narrowly linear, 6–12 in. long, 2–4 lines wide, deeply channeled, distinctly spotted white: scape 4–6 in. long: raceme 12–20-fld., quadrangular in outline, 4–6 in. long, 6–9 in. wide: lower pedicels in fr. spreading: fls. with outer perianth segments margined white. Mediterranean region. Escaped from old gardens in U. S.

CC. *Number of flowers 3–12.*

exscàpum, Tenore. Bulb ovoid, ¾–1 in. thick, not proliferous: lvs. 5–6, narrowly linear, 4–6 in. long, 1–2 lines wide, glabrous, spotted, disappearing after the fls.: scape 1–1½ in. long: raceme 3–12-fld., quadrangular in outline, 1½ in. long, 2½–3 in. wide: lowest pedicels in fr. deflexed: bracts ¾–1 in. long, shorter than the pedicels: fls. with outer perianth segments margined white: style very short. S. Eu.



1594. Ornithogalum Arabicum (× ⅓).

AAA. *Flowers more or less white-faced, but keeled with green on the back.*

B. *Blossoms nodding.*

nùtans, Linn. Bulb ovoid, 1–1½ in. thick, producing offsets freely: lvs. pale green, 1–1½ ft. long, 3–6 lines wide, disappearing after the fls.: scape 8–12 in. long: raceme 3–12-fld., oblong-cylindrical in outline: pedicels shorter than the bracts: fls. green, margined white on back, the lower ones nodding. Eu., Asia Minor. B.M. 269. Gn. 32:621 & p. 77; 41, p. 376.—Rarely escaped in U. S.

BB. *Blossoms erect or ascending.*

C. *Width of leaves 3–6 lines.*

Narbonénse, Linn. Bulb ovoid, 9–15 lines thick: lvs. strap-shaped, 1–1½ ft. long, 3–6 lines wide, glabrous, glaucous green, scarcely disappearing before the end of flowering: scape 1–1½ ft. long: raceme 20–50-fld., oblong-cylindrical, 4–8 in. long, 1½–2 in. wide: lowest pedicels 9–15 lines long: fls. whitish, keeled green on the back; filaments lanceolate at base, not squared. S. Eu. B.M. 2510 (striped, green back and front).—*O. pyramidàle*, Linn., is considered by Baker to be a robust, large-fld. garden form, but it is said to grow wild in Spain and Portugal and may be a distinct species. Fls. white, with a green stripe on back. Gn. 41:854.

CC. *Width of leaves 9–18 lines.*

D. *Filaments alternately linear and lanceolate.*

longebracteàtum, Jacq. Lvs. rather fleshy, glabrous, lanceolate, 1½–2 ft. long, ¾–1½ in. wide, persistent until after flowering: scape 1½–2 ft. long: raceme dense, 30–60-fld., oblong-cylindrical, 6–9 in. long, 15–18 lines wide: lowest pedicels 9–12 lines long: fls. whitish, keeled green on the back: bracts 9–15 lines long; filaments alternately linear and lanceolate at the base. S. Afr.—Baker says the bulb is 3–4 in. thick.

DD. *Filaments alternately lanceolate and quadrate at the base.*

caudàtum, Ait. Lvs. lorate, 1½–2 ft. long, 1–1½ in. wide: scape 1½–3 ft. long: raceme dense, ½–1 ft. long: fls. banded green on face, and keeled green: bracts 6–9 lines long. S. Afr. B.M. 805. Window plant.

AAAA. *Fls. white, with a brown or greenish yellow eye: perianth segments revolute.*

revolùtum, Jacq. Lvs. lanceolate, 6–9 in. long, 6–9 lines wide: fls. not keeled with green, many in a subcorymbose cluster; style very short and stout. S. Afr. B.M. 653. B.R. 4:315.

W. M.

ÓROBUS is considered a subgenus of Lathyrus, but for *O. formosus*, see *Pisum*, and for *O. lathyroides*, see *Vicia*. Since Lathyrus was written for this work, the names of 3 other species of Orobus have been prominently mentioned in this country: *O. aurántius*=*Vicia aurántia; O. fláccidus*=*Lathyrus vernus*, var. *flaccidus*, Ser., which is distinguished from the type by its very narrow, flaccid lvs.; and *O. Pannonicus*, a puzzling name, which is discussed in the next paragraph.

Orobus Pannonicus, Jacq., is by Index Kewensis referred to *Lathyrus Pannonicus*, Garcke, but older authorities, as DeCandolle and Koch, refer it to *Lathyrus albus*, Linn. f. *L. albus* differs from other species as follows: root of clustered, club-shaped fibers: stem angled, unbranched, narrowly winged above: lfts. 2–3 pairs, linear-lanceolate and linear: style linear. Normally it has white or yellowish fls., with the standard often flushed rose color on the back; but var. *versicolor*, Koch, has a purple standard, with yellow wings and keel. This is B.M. 675 (as *O. varius*) and probably the form in cult.

ORÓNTIUM (one of many names arbitrarily applied by Linnæus; he probably had in mind some water plant growing in the Syrian river Orontes). *Aràceæ*. GOLDEN CLUB. *Orontium aquaticum*, or Golden Club, is a hardy, native, aquatic plant, which bears in early spring yellow "clubs" on white stalks. The "club" is a cylindrical spadix 1–2 in. long. The lvs. are ascending or floating, according to the depth of the water. They are oblong-elliptic, with a blade 5–12 in. long, and no distinct midrib, but numerous parallel veins. The foliage is handsome, dark velvety green above, silvery below. The plant is very strong and deeply rooted, growing in water 10–18 in. deep. On account of its firm hold on the soil it may be planted in swifter water than most aquatics. It has the fault of being difficult to eradicate when firmly established.

Orontium is a genus of one species, which is found in swamps and pools from Mass. to Fla., mostly near the seacoast, but extending as far inland as central Pa. and La. Spathe usually soon deciduous: fls. hermaphrodite, covering the whole spadix; sepals scale-like, imbricated upon the ovary, usually 4 in the upper and 6 in the lower fls.; ovary 1-celled; ovule solitary, semi-anatropous: fr. a green utricle.

aquáticum, Linn. GOLDEN CLUB. Blade of lvs. 5–12 x 2–5 in.: stalk 4–20 in. long: scape ½–2 ft. long. B.B. 1:364. L.B.C. 5:402. R.H. 1888:85. Gn. 27, p. 213.

F. W. BARCLAY.

ORÓXYLON (Greek, *a mountain tree;* nevertheless it grows anywhere from sea-level to an altitude of 3,000 ft.). Also written *Oroxylum*. *Bignoniàceæ*. A genus of one species, an Indian tree, which, as Franceschi says, is "remarkable for the large size and striking form of its leaves, almost black flowers, and long, sword-shaped pods." This tree is cult. outdoors in S. Calif. and under glass in Europe. It attains 25–40 ft. in India, has lvs. 2–4 ft. across, which are shining and twice or thrice ternately pinnate; lfts. 5 x 3–4 in.: raceme 10 in. long: fls. fleshy, 2½ in. long, 2–3½ in. across, bell-shaped, and white or purplish according to the Flora of British India.

This tree has no near ally of garden value. It might be roughly compared to a Catalpa for its long pods and winged seeds, and for its much-cut foliage to *Jacaranda ovalifolia*, which is one of the most striking and elegant trees cultivated in subtropical countries. Generic characters are: calyx large, leathery, truncate or obscurely toothed: corolla-lobes 5, subequal, round, crisped, toothed: stamens 5: capsule septicidally 2-valved: seeds thinly discoid, with a broad, transparent wing.

Índicum, Vent. Lvs. opposite; lfts. ovate, entire: peduncle 1 ft. long: capsule 1–3 ft. long, 2–3 in. wide, hardly 4 lines thick. India, Ceylon, Cochin China, Malaya.

ORPINE or **STONE CROP.** See *Sedum*, particularly *S. Telephium*.

ORRIS-ROOT or **IRIS-ROOT.** See *Iris Florentina* and *Perfumery Gardening*.

ORTHOCÁRPUS (Greek, *straight fruit*, which distinguishes this genus from Melampyrum). *Scrophulariàceæ*. *O. purpuráscens*, Benth., is a plant something like the Painted Cup (Castilleia). It is a Californian annual, growing a foot or less high, with yellow, crimson-tipped fls. and gaudy bracts. Gray says it is "common along the hills and mountains of the coast, from San Diego to Humboldt Co., so abundant as to give the ground a purple hue for miles in some places; occasionally, with duller or only pallid color, in salt marshes. The reddish, soft and copious beard of the narrow and hooked upper lip which marks this species is composed of many- and close-jointed hairs." This plant was offered in 1891 by Orcutt. For fuller description see Gray's Syn. Flora of N. Amer. In Orthocarpus the calyx is 4-cut; in Castilleia many-cut.

ORTHROSÁNTHUS (Greek, *morning flower;* because the fls. open in the morning and fade before noon). *Iridàceæ*. *O. multiflorus* is a charming plant something like our blue-eyed grass or Sisyrinchium. It has a tuft of grassy foliage a foot or two high, and sky-blue, 6-parted fls. an inch or more across, which open one after another for a week or so. Horticulturally it is classed among tender bulbs, though its rootstock is a short, thick rhizome. This choice plant comes from Australia, which, unlike the Cape of Good Hope, is very poor in showy bulbous plants of the iris, lily and amaryllis families.

Orthrosanthus is a genus of 7 species, 2 from tropical America and 5 from Australia. Lvs. firm, linear, equitant: clusters many-fld., panicled: fls. pale blue; pedicels so short that the capsule is not protruded from the spathe; perianth-tube very short or none; segments oblong, nearly equal, spreading; filaments free or connate only at the base: ovary 3-celled; ovules many, superposed; style-branches alternating with the anthers: seeds minute, very near Sisyrinchium, which is a more variable genus, and has longer pedicels. See Baker's Handbook of the Irideæ (1892).

There seems to be no recorded American experience with *O. multiflorus*. Krelage lists it among bulbs suitable for frame culture. Nicholson says it thrives and does best when planted in the border of a cold conservatory, and adds "if, however, it is necessary to grow them in pots, use turfy loam and leaf-mold, and insure sufficient drainage."

multiflòrus, Sweet (*Libértia azùrea*, Hort.). Lvs. a dozen or more, 1–1½ ft. long, ⅛ to ⅙ of an inch wide: panicle 4–6 in. long: capsule obtuse. Southern and western Australia. L.B.C. 15:1474. B.R. 13:1090 (as *Sisyrinchium cyaneum*). W. M.

ORỲZA (derived from the Arabic name, Eruz). *Gramíneæ*. Six species of the tropics, including *O. sativa*, Linn., the well-known rice of commerce. This is a native of the Old World tropics, and is naturalized in Brazil; cultivated extensively in China and India and more recently in the coast region of our southern states. A marsh plant, with flowers in panicles; spikelets 1-fld.; empty glumes 2, small; fl.-glume and palet about equal, laterally compressed, keeled, the former usually more or less awned. Contrary to the usual supposition, rice paper is not made from rice, but from Paper Mulberry or Bamboo. A. S. HITCHCOCK.

ORYZÓPSIS (Greek, *rice-like;* from a fancied resemblance to that grain). *Gramíneæ*. MOUNTAIN RICE. Contains about 24 species of temperate regions. Mostly tufted perennials, with narrow panicles of rather large greenish 1-fld. spikelets. Empty glumes thin, nerved, nearly equal: fl.-glume coriaceous, becoming involute, provided at base with a short callus, and at apex with a simple untwisted deciduous awn. Three of our native species are offered by dealers in wild plants.

melanocárpa, Muhl. Distinguished by its leafy culm, the lvs. being broad and flat: panicle simple or compound; fl.-glume blackish: awn about 1 in. long. Rocky woods, New Eng. to Mo.—Blooms late in summer.

asperifòlia, Michx. This and the next have tufted, naked culms, with flat, concave or involute lvs.: culms 9–18 in. high, bearing sheaths with rudimentary blades: lvs. rough-edged, evergreen: awn ½ in. long. Northern states to Colorado.—Blooms early in spring.

Canadénsis, Torr. Culm 6–15 in.: lowest sheaths leaf-bearing: lvs. involute, thread-shaped: awn very short, deciduous or wanting. Me. to Minn., on rocky hills; rare. A. S. HITCHCOCK.

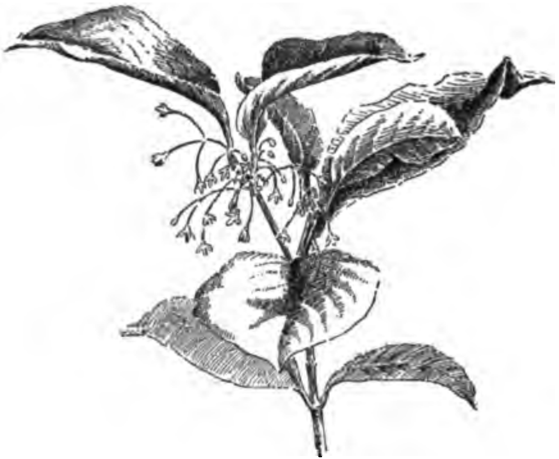
OSAGE ORANGE. See *Toxylon*.

OSIERS are willows used for baskets and willow-ware in general. Some dogwoods are also called Osiers. The various kinds are described under Salix and Cornus. Osier culture is generally considered as belonging to sylviculture rather than to horticulture, and is therefore not treated here, but the interested reader should procure "Osier Culture," by John M. Simpson, a pamphlet of 27 pages, issued in 1898 as Bulletin 19 of the Div. of Forestry, U. S. Dept. of Agriculture.

OSMÁNTHUS (*fragrant flower*). *Oleàceæ*. The cultivated members of this genus are usually known as Oleas, but Osmanthus is distinguished from Olea by its imbricate rather than valvate obtuse corolla-lobes: fls. fascicled or in short, perfect or imperfect racemes: lvs. generally opposite, entire or serrate, thickish: evergreen trees or shrubs, of 7 or 8 species in eastern Asia, Pacific islands, and one in North America. *O. fragrans* is the only common species in cult., and this is a greenhouse plant in the North, being grown for its very fragrant fls. It is of the easiest culture in an intermediate temperature. It is almost a continuous bloomer, although ordinarily it should be rested in late winter or summer in order to ripen the wood for fall and winter bloom. Be careful not to overpot, and keep the plant free from mealy bug. In the South and in California, it thrives when planted out in a place shaded from the midday sun.

A. *Lvs. small-toothed or entire.*

fràgrans, Lour. (*Òlea fràgrans*, Thunb.). Fig. 1595. Small tree or shrub, usually cult. as a pot-plant: lvs. oval to oblong and lanceolate, finely sharp-toothed (said to be entire in the wild plant), thick, lighter colored and veiny beneath: fls. small, white, the corolla divided nearly to the base, in clusters in the upper axils, very fragrant: fr. not produced on the cult. plant, but on the wild plant said to be ellipsoid and ¾ x ½ in. India, China, Japan. B.M. 1552. L.B.C. 18:1786.



1595. Osmanthus fragrans (× ½).
Olea fragrans of gardens.

Americànus, Benth. & Hook. DEVIL-WOOD. FLORIDA OLEA. Glabrous small tree or tall shrub, with whitish bark: lvs. thick, evergreen, lance-oblong, with a short petiole, entire, shining above: fls. polygamous or diœcious, dull white, in panicles which are shorter than the lvs., fragrant: fr. a small dark purple drupe. Blooms in spring. N. Car., south. S.S. 6:279, 280.—This plant is in cult. in choice collections south, but it is not now advertised.

AA. *Lvs. usually spiny-toothed and holly-like.*

Aquifòlium, Sieb. Small, evergreen tree, with elliptic or oblong-ovate, stiff spiny-toothed, shining lvs., 3–4 in. long: fls. white, in short axillary clusters appearing in autumn, very fragrant, larger than in *O. fragrans*. Japan. G.C. II. 6:689. Very variable. Var. **ilicifòlius**, Hort. (*Olea ilicifòlia*, Hassk.), is a compact dense shrub, with smaller lvs. There are variegated-leaved forms (as *O. Aquifolium*, vars. *aureum* and *argenteum*). Var. **myrtifòlius**, Hort., has compact habit, with rigid, spineless lvs. *Osmanthus Aquifolium* is hardy with some protection as far north as Baltimore and Philadelphia. Variegated forms are sometimes grafted on privet, but they lack in constitution.

O. latifolia and *O. ligustrifolia* of the trade are probably Phillyreas. *O. buxifolia*, Hort., is probably Olea Capensis, Linn., a shrub from S. Africa. L. H. B.

OSMORHÌZA (Greek; referring to the sweet, aromatic, edible roots). *Umbelliferæ*. A small genus of perennial herbs, 1–3 ft. high, with ternately decompound foliage and white fls. in few-rayed umbels. They are sometimes called Sweet Cicely, but the true Sweet Cicely is *Myrrhis odorata*, a closely allied European plant, the lvs. of which have the scent of anise seed and are used in flavoring. Two western species were once advertised in the eastern states, and 2 eastern species are rarely offered. F. W. Barclay, who has charge of a very large collection of native plants, writes that the eastern species require a loose, rich, rather moist loam. He adds that they are usually to be found in shady places, but where soil conditions are suitable they do well in the sun. Wilfred Brotherton remarks that their foliage turns a handsome purple in autumn.

Generic characters: Calyx-teeth obsolete: fr. linear, glabrous or bristly; carpel slightly flattened dorsally or not at all; styles long or short; seed-face from slightly concave to deeply sulcate. Coulter and Rose, Monograph of North American Umbelliferæ, 1900. The generic name is also spelled *Osmorrhiza*.

A. *Fr. with prominent caudate attenuation (2–4 lines long) at base, very bristly.*

B. *Style a line or more long.*

longistylis, DC. Stout, glabrous or slightly pubescent. Canada to Va. and west to Dakota. B.B. 2:530.—Roots with a stronger smell and taste of anise than *O. brevistylis*. Brotherton says it is a much prettier plant than the next, with larger umbels.

BB. *Style half a line or less long.*

C. *Lfts. 2–3 in. long: rays stout, 1–2 in. long.*

brevistylis, DC. Rather stout, villous-pubescent: lvs. 2–3-ternate: style and stylopodium half a line long. Canada to N. C. B.B. 2:530.

CC. *Lfts. ½–2 in. long: rays slender, 2–4 in. long.*

nùda, Torr. Rather slender, somewhat pubescent or glabrous: lvs. twice ternate: style and stylopodium ¼ line long. Mts., Calif.

AA. *Fr. without caudate attenuation at base.*

occidentàlis, Torr. (*Mýrrhis occidentàlis*, Benth. & Hook.). Rather stout, puberulent or pubescent: lvs. 2–3-ternate; lfts. 1½–4 in. long: umbel 5–12-rayed: rays 1–5 in. long: stylopodium and style ½–1 line long. Calif. to Wash., east to Montana. W. M.

OSMÚNDA (from *Osmunder*, a name of a Saxon god). *Osmundàceæ*. A small genus of showy native ferns, with rather coarse foliage, but highly ornamental from their clustered habit. The sporangia are formed in panicles borne on the veins of reduced lvs., provided with a rudimentary transverse ring and opening vertically.

A. *Lvs. fully bipinnate.*

regàlis, Linn. ROYAL FERN. Growing in clumps 2–5 ft. high, some of the leaves bearing panicles at their summits; pinnæ 1–2 in. long, rounded at the base and usually blunt. Well adapted for open, moist places. Eu., N. Amer. and Japan.—Commonly called Flowering Fern or King-fern. *O. Japonica*, Thunb., is a form with the sporophylls forming distinct leaves and soon withering away; various crested forms appear in cultivation.

1596. Royal Fern—Osmunda cinnamomea.

AA. *Lvs. bipinnatifid only.*

cinnamòmea, Linn. CINNAMON FERN. Fig. 1596. Plate XI. Growing in clusters 2–4 ft. high or even more, the sporophylls appearing earliest, at first green, but becoming pale, long and narrow, cinnamon-colored at maturity of the spores, the lvs. growing about a crown from a large, mostly vertical rootstock. N. Amer.—Very handsome for decorative purposes, especially for low grounds.

Claytoniàna, Linn. Growing in crowns, with the sporangia confined to a few (4–10) of the central pinnæ of the leaf, and of a dark brown color. Similar to the last, but lacking the little tuft of wool in the axils of the pinnæ which characterizes the Cinnamon Fern. N. Amer; said also to grow in India.

L. M. UNDERWOOD.

Osmundas are strong-growing ferns of vigorous constitution, and well adapted for general culture in any fertile soil which is not over dry. They are deep-rooted ferns and, therefore, require considerable depth of soil. All the species do well in full sunlight, but the most satisfactory position for all the species would be a deeply dug, thoroughly enriched border lying north of a wall. *O. regalis* reaches perfection only in rich, wet swamps in full sunlight or thin shade, where it may attain a height of 8 ft. *O. Claytoniana* prefers rich, peaty soil in moist but not wet, open or partially shaded positions. It may attain a height of 6 ft. *O. cinnamomea* is naturally a fern of the swamp, though not in such wet positions as *O. regalis*. It grows most luxuriantly in partial shade. In a wild state it occasionally attains a height of 6 ft.

F. W. BARCLAY.

OSTEOMÈLES (Greek, *stone apple* or *stone fruit*). *Rosàceæ*. The plant which bears the uncomfortable name of *Osteomeles anthyllidifolia* is a white-fld., red-fruited bush, ranging from China through the Pacific islands as far south as Pitcairn's island. It has pinnate foliage, silvery beneath, each leaf 2–4 in. long and composed of about 25 lfts. The specific name of the plant records its resemblance in foliage to *Anthyllis Barba-Jovis*, a plant with pea-like fls., known as Jupiter's Beard, which is considerably used for seaside planting in frostless countries. Botanically Osteomeles is closest to our shad bush (Amelanchier), but inferior in hardiness and in beauty of fls. All the other species of Osteomeles (about 7) are natives of the Andes, and have simple lvs. The silvery nature of *O. anthyllidifolia* varies considerably in the wild, and glabrous specimens have been collected.

Generic characters: trees and shrubs: lvs. alternate, stalked, leathery, evergreen, entire or serrate: fls. white, few or numerous, in flattish clusters: calyx-tube bell- or top-shaped, adnate to the carpels; lobes 5, persistent; petals 5, oblong; stamens 10 or more, inserted on the throat of the calyx; carpels 5, more or less grown together and to the calyx: drupes 5-stoned.

anthyllidifòlia, Lindl. Evergreen bush, 5–6 ft. high, much branched: bark brownish black: lvs. spreading and recurved; lfts. more or less in pairs, yellowish green: fls. about ⅔ in. across, a dozen or so in a cluster. B.M. 7354. W. M.

OSTEOSPÉRMUM moniliferum is a shrubby yellow-fld. composite, growing 2–4 ft. high, which was offered in 1891 by Reasoner Bros., Oneco, Fla. It has dropped out of cult. It is fully described in Flora Capensis 3:433, where the entire genus of 38 species is monographed.

OSTRÓWSKIA (after N. ab Ostrowsky, Russian patron of science). *Campanulàceæ*. The GIANT BELL-FLOWER, *O. magnifica*, ranks among the two dozen most interesting "hardy perennials" introduced during the last two decades of the nineteenth century. Each stem grows 4 or 5 ft. high, is branched only at the top, and bears 3–6 bell-shaped, pale lilac fls. 4–6 in. across and 4 in. deep. A healthy clump may throw up as many as 6–10 stems. Before the discovery of this plant, *Platycodon grandiflorum* was generally considered the showiest of all the large bell-flowers, but J. N. Gerard declares that the Platycodon is very commonplace beside Ostrowskya. In the colored plates the flowers have a rather washed-out appearance, except in "Garden," which shows pinkish tints. Gerard describes the color as a very light lavender or mauve, almost white, with deeper veinings.

A dark blue variety was thought to exist, but unfortunately nothing of the kind has been seen in cultivation. Altogether it is a very singular plant, with its great fleshy roots, sometimes 2 ft. long, its whorled lvs., and the conspicuous pores of the capsule, which are twice as numerous as the sepals—a generic character. Unlike Platycodon, its lvs. are membranous and light green. It is the only species in the genus. As a genus Ostrowskya is close to Campanula, being distinguished by the whorled lvs. and the floral parts numerically greater.

The Giant Harebell needs a deeply worked, perfectly drained, sandy soil. Soon after flowering the plants go to rest and nothing is left of them above ground. Their place should be carefully marked to protect the brittle roots from careless digging. Our dry summers and autumns seem to suit the plants well, but frequently in a moist October growth starts and this seriously weakens the old plants. When only a few plants are grown, a tight board covering will be found convenient for keeping the roots dry and dormant. For winter protection it is advisable to give a liberal covering of litter. Excessive moisture will destroy the crown. Flowering specimens can hardly be expected within 4 years from seed, and seeds are slow to germinate unless fresh. Nurserymen now propagate the plant by cuttings of the young growths taken with a heel in spring; amateurs by root-cuttings.

magnifica, Regel. GIANT BELL-FLOWER. Tall, strict, glabrous herb, with tuberous roots: lvs. in distant whorls of 4 or 5, ovate, toothed, short-stalked, 4–6 in. long: calyx-lobes 2 in. long, spreading or recurved: floral parts 5–9, usually 7: style large, thick, yellow. Eastern Bokhara, at 7,000 ft. Gn. 34:681; 52, p. 481. B.M. 7472. G.F. 6:276. A.F. 4:331. V. 11:305. G.M. 31:459, 461. R.H. 1893:472 and p. 473; 1888, p. 344. I.H. 35:71. G.C. III. 4:65. S.H. 1:437.

J. B. KELLER and W. M.

ÓSTRYA (ancient name). *Cupuliferæ. Ostrya Virginica*, commonly known in America as Hop Hornbeam, Ironwood or Leverwood, is a small- to medium-sized tree, with birch-like foliage, slender yellow male catkins borne in spring, and female catkins which look like clusters of hops, and ripen in July and August. In the eastern states the Hop Hornbeam usually grows about 15 to 18 ft. high, but in the Middle West it grows much higher, sometimes attaining 50 ft. The bark is beautifully furrowed. The species has a wide range, but is not common. *O. carpinifolia*, Scop., and *O. Japonica*, Sarg., have proved hardy at the Arnold Arboretum.

Ostrya is a genus of 4 species—the following, one in southwestern U. S., one in Eu. and Asia and one in Japan. Catkins borne with the lvs. or before; males drooping, sessile at the ends of branchlets of the previous year, their fls. solitary in the axil of each bract; females terminal, solitary, erect, their fls. 2 to each bract, enclosed by a bractlet, which in fruit enlarges into a closed membranous bladder: male fls. without bractlets; stigmas 2: nut compressed, sessile in the base of the bladder-like sac.

Virgínica, Willd. Fig. 1597. Lvs. ovate or oblong-ovate, acuminate, doubly serrate: bladders 6–8 lines long, 4–5 lines wide in fruit; female catkins 1½–2½ in. long. Dry woods, Cape Breton to Minn., south to Fla. and Tex. S.S. 9:445. B.B. 1:507. Gn. 24, pp. 230, 231.

OSWEGO TEA. *Monarda didyma.*

OTHÈRA Japónica, imported by Berckmans, Augusta, Ga., is an evergreen shrub, with obovate or oblong-obovate glabrous lvs., entire or nearly so, and 2–3 in. long. There can be but little doubt that it is a species of Ilex, but the shape of the lvs. does not agree exactly with the figure given by Thunberg of his *O. Japonica*, which was subsequently referred to Ilex by Sprengel under the name *I. Othera*. In none of the more recent publications on the Japanese flora, however, is either name mentioned, and it is likewise omitted in the monograph of Ilex by Maximowicz. As the genus Othera has no botanical standing it is perhaps the best to use *Ilex Othera* as a provisional name for the cultivated plant until it has borne fls. and fr., and thus enabled us to determine its exact botanical position. In foliage it resembles very much *I. integra*, and it may probably prove to be this species when the fruits are known. The *Othera Japonica* of Thunberg as figured in his Icones Plantarum Japonicarum, pl. 13, is much like *I. rotunda*, and may represent a plant of this species with staminate fls. The hardiness of the cultivated *Ilex Othera* is probably the same as that of *I. latifolia* and *integra*, and also its cultivation and propagation. See *Orixa*.

ALFRED REHDER.

Othera Japonica, a very beautiful ornamental evergreen shrub or small tree, is well established in several Florida gardens. In the late E. H. Hart's garden, at Federal Point, Fla., there is a small, bushy, dense tree, about 22 feet high, which has flowered and fruited abundantly. Two plants in my own garden, one on high pine land, the other in richer soil near the lake, have done exceedingly well, though the one in moist ground is by far the larger and very dense. They were planted out in the fall of 1896, and the most vigorous one is now 7 feet high, and as much in diameter, provided with branches from the ground. The plant resembles *Ilex integra*, but is different in habit and growth. Whatever its correct botanical name may be, it is a very beautiful plant for the extreme South, and it well responds to good cultivation and fertilizing.

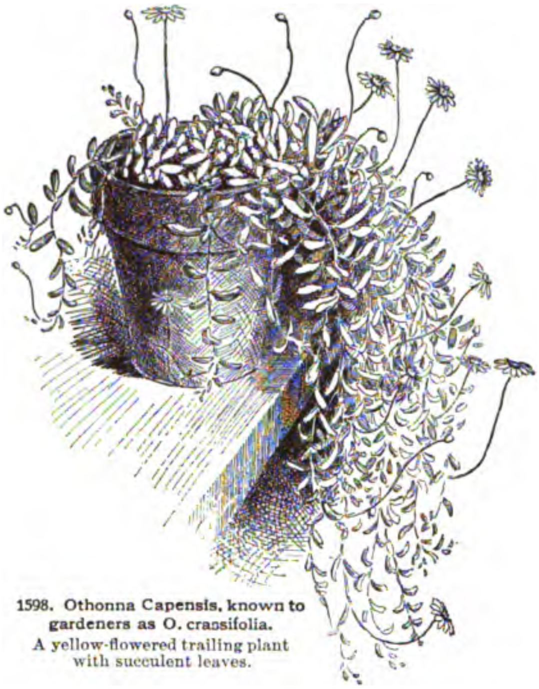
H. NEHRLING.

OTHÓNNA (ancient Greek name, of no particular application here). *Compósitæ*. About 80 South African herbs and shrubs, of which one (Fig. 1598) is in general cultivation as a window-garden plant. The heads are usually yellow, with fertile rays and sterile tubular disk florets: torus convex or somewhat conical, usually honeycombed: scales of involucre in one series, more or less united to the base, valvate: style of disk fls. not divided: akenes oval, with bristle-like pappus in many rows or series. Only one species of Othonna appears to be in general cultivation, and this has no established vernacular name in this country, although it is sometimes dubbed "Little Pickles" because of its cylindrical, pulpy leaves.

1597. Hop Hornbeam—Ostrya Virginica (× ¼).

The plant shown in Fig. 1598 is commonly known as *Othonna crassifolia*, but thereby arises a puzzle in nomenclature. By Linnæus a certain flat-leaved plant was called *Othonna crassifolia*. Subsequently some of the species of Othonna were separated by Jaubert & Spach into a distinct genus, Othonnopsis, distinguished by involucral scales distinct and style of the disk florets 2-parted. One of the plants relegated to this new genus was *Othonna cheirifolia*, Linn., which then became *Othonnopsis cheirifolia*, Jaub. & Spach. Bentham & Hooker consider Linnæus' *Othonna crassifolia* to be a horticultural form of *Othonnopsis cheirifolia*. It was therefore a natural sequence to say that the *Othonna crassifolia* of horticulturists is properly *Othonnopsis cheirifolia*, a statement which the writer made in the revision of Gray's "Field, Forest and Garden Botany." It turns out, however, that the *Othonna crassifolia* of horticulturists is not the *Othonna crassifolia* of Linnæus (if he has been correctly reported). The former plant is a true Othonna. It is the *Othonna crassifolia* of Harvey; but since this name *crassifolia* was used by Linnæus, it cannot be used again in the same genus, and Harvey's plant must take some other name. In fact, before Harvey's time, the name *Othonna crassifolia* was used by Meyer for still another species. The *O.*

crassifolia of Harvey was once described as *O. filicaulis*, but this name also has been previously used in the genus. It seems, therefore, as if a new name must be given to the *O. crassifolia* of Harvey and of the horticulturists, and this is done below. What, now, is Linnæus' *Othonna crassifolia?* As early as 1771, this plant was figured in color by Philip Miller as the "*Othonna foliis lanceolatis integerrimis*" of Linnæus' Hortus Cliffortianus. It was figured again by Edwards in 1818 (B.R. 4:266). It is an upright or ascending undershrub, with flat leaves reminding one of leaves of the stock. It is described in the European books, but is probably not in commercial cultivation. It is native to the north of Africa. A reproduction of part of Philip Miller's picture of the plant, reduced in size, is shown in Fig. 1599.



1598. Othonna Capensis, known to gardeners as O. crassifolia.
A yellow-flowered trailing plant with succulent leaves.

Capénsis (*Othónna crassifòlia*, Harv., not Linn., nor Meyer. *Othonnópsis cheirifòlia*, Bailey in "Field, Forest, and Garden Botany," not Jaub. & Spach). Fig. 1598. Perennial, becoming shrubby at base in its native country, glabrous, with slender trailing or drooping stems: lvs. 1 in. or less long, fleshy and cylindrical-obovoid, sharp-pointed, either scattered or in clusters: pedicels 2–6 in. long, ascending, slender: heads nearly or quite ½ in. across when well grown, the narrow, bright yellow rays wide-spreading. S. Africa.—An excellent plant for hanging baskets, for it withstands extremes of moisture and temperature. It is readily propagated by planting pieces of the stems. It blooms in nearly all seasons. Fls. open only in sun. L. H. B.

OURÍSIA (Gov. Ouris, of the Falkland islands). *Scrophulariàceæ*. *O. coccinea* is a choice alpine of tufted habit, heart-shaped lvs., and scarlet, narrowly funnel-shaped fls. 1–1¼ in. long. The general appearance of the inflorescence is distinct. The fls. are borne in opposite pairs to the number of 12 on a scape a foot or more high. Each flower points at a sharp downward angle from its slender red fl.-stalk, which is as long as the flower. The fls. are 2-lipped, 5-lobed and bulged at the very base. This rare and charming plant is cultivated in America, but not advertised at present. The secret of its culture is a stiff soil combined with deep shade. (See, also, *Alpine Gardens*.)

Botanically, Ourisia is allied to the foxglove, to which it has no casual resemblance. It is a genus of 23 species, mostly natives of the Chilean and Peruvian Andes. Herbs, rarely somewhat woody at the base, usually dwarf, decumbent or creeping a short distance, glabrous or sparsely hairy: fls. either axillary and solitary, or in a raceme at the apex of a scape, usually scarlet- or rose-colored; corolla-tube cylindrical or slightly bell-shaped at the throat, lobes nearly equal: stamens 4, didynamous: style entire.

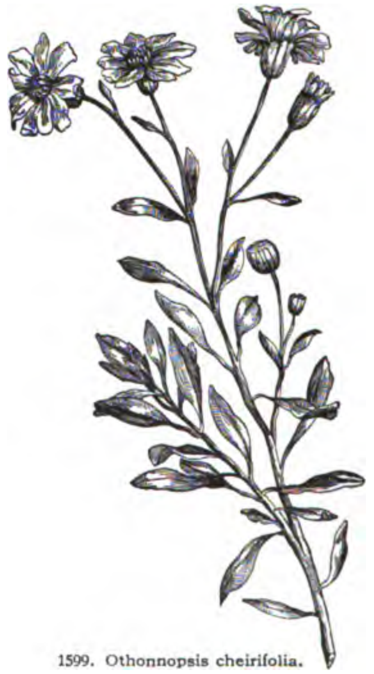
coccínea, Pers. Hardy herbaceous perennial, sparsely hairy: lvs. mostly radical, long-stalked, heart-shaped, unequally lobed and crenate: scape furnished with 1- or 2-stalked lvs. at the base, and pairs of toothed bracts, from which the pedicels arise: calyx-lobes 5, short, spreading. Chile. B.M. 5335.

J. B. Keller and W. M.

OUVIRÁNDRA (Madagascar name meaning *water yam*, referring to the edible tubers). *Naiadàceæ*. The Lace-leaf or Lattice-leaf plant, *O. fenestralis*, is one of the most distinct and interesting plants in the vegetable kingdom. It grows in Madagascar, its skeletonized leaves floating just under the surface of the water. The lvs. are merely a tracery of nerves and cross-veins, but despite their lace-like delicacy they can be handled with considerable roughness. The plant is cultivated in all the finest collections of tender aquatics. The lvs. are oblong in shape, and in fine specimens 6–18 in. long and 2–4 in. broad. See Fig. 1600.

The genus and even the family of this plant is a subject of much debate. If it were not for the skeletonized foliage the plant would be referred by all to Aponogeton. However, the venation of the Lace-leaf plant is exactly that of Aponogeton, and now and then a leaf occurs in which the spaces between the veins are partly or wholly filled with green matter. Edgeworth declared that if Ouvirandra were kept distinct then 4 species of Aponogeton must go with it. *O. fenestralis* is all but unique. There is another species with skeletonized leaves (*O. Bernieriana*), but the open spaces are smaller and the plant is less desirable for cult. The prevailing tendency of the day is to refer both these plants to Aponogeton.

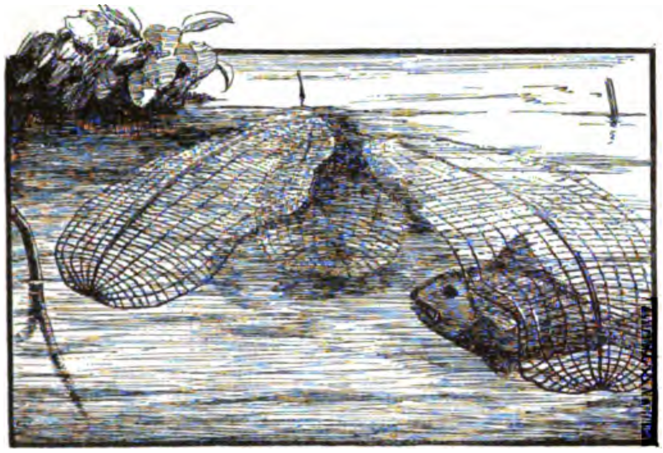
The Lace-leaf plant can be grown in a tub in a warm greenhouse. For some unknown reason the plant seems rarely to succeed in a jar or glass aquarium. In Mada-



1599. Othonnopsis cheirifolia.

A flat-leaved plant which has been confused with *Othonna Capensis*. For comparison with Fig. 1598.

gascar, according to the Botanical Magazine, the plant grows in running water. Some cultivators think that the water must be changed every day, but this is not necessary. If confervæ appear, introduce a few tadpoles and snails; these will devour the green scum, and help to keep the plant in good health by furnishing oxygen. (See *Aquarium*.) The plant should be potted, and plunged not more than 18 inches below the surface of the water. For potting soil use a rich compost, such as is recommended for Nymphæas. The water should be kept clean and sweet, and a temperature of 65° to 75° provided. Avoid direct sunlight.



1600. Lace-leaf plant—Ouvirandra fenestralis.

In Madagascar the streams often dry up, and the tubers carry the plant over the dry season. In imitation of nature some cultivators take the tubers out of the soil, and leave them on a shelf in a hothouse during the month of February. It is doubtful whether this is necessary. Potting should be done while the plant is in active growth, not dormant. Prop. by division.

fenestràlis, Poir. (*Aponogèton fenestràle*, Hook.). Fig. 1600. The fls. are small, and consist of 6 stamens, 3 pistils and 2 white petal-like bodies. The fls. are numerous, and borne in 2 spikes, each about 2 in. long, which are united at the base, and borne on the top of a scape a foot or so long. A.F. 7:67. A.G. 15:169. B.M. 4894. G.M. 38:830. Gn. 30, pp. 344, 345. Mn. 6, p. 231. F.S. 11:1107. I.H. 8:300.

O. Bernieriàna, Decne., differs in having smaller open spaces in the lvs., and pinkish 4-parted spikes.

Wm. Tricker and W. M.

ÓXALIS (*sharp;* referring to the usual acidity of the foliage). *Geraniàceæ*, sometimes treated as a family, *Oxalidàceæ*. Over 200 species, mostly of South Africa and tropical and subtropical America. A few are weeds or woodland plants through the northern countries of both hemispheres. Mostly bulbous or tuberous herbs, with clover-like lvs., cultivated in borders and rockeries or especially as hanging-basket or window plants for their flowers; a few used in salads, and several of the South American species grown for their edible roots or tubers. The fls. usually close at night and in cloudy weather, and the leaves "sleep" at night (Fig. 1601).

O. Acetosella produces, in addition to the showy flowers, others, concealed by the leaves, which are fertilized in the bud, like those of our native blue violets. The bulbous and tuberous species commonly consist of three otherwise similar forms, in the flowers of which the styles are respectively longer than, intermediate between, and shorter than the two sets of stamens; but the native *O. violacea* produces only the first and last of these three forms of flowers, which are designated as long-styled, mid-styled and short-styled. Several species, often treated as belonging to a separate genus, Biophytum, possess pinnate sensitive lvs.

Prop. by division of the compound bulbs or separation of the young bulbs produced at the ends of underground roots by some species, or division of the clumps of those which are tuberous, the fibrous-rooted caulescent species prop. by cuttings or division. Nearly all may be grown from seed, but this process is slower, and some rarely seed in cultivation.

Planted in rich, well-drained sandy loam in spring, they bloom continuously through the season, and are lifted for winter blooming; sometimes dried off in spring, and started into growth in autumn for indoor baskets, etc. The caulescent species are kept in continuous growth like Pelargoniums, usually in the temperate house.

The classical works on Oxalis are Jacquin's "Oxalis, Monographia, iconibus illustrata" (1794), with exquisite plates; and Zuccarini's "Monographie der Amerikanischen Oxalis-Arten," and "Nachtrag zu der Monographie der Amerikanischen Oxalis-Arten" (1825–1831). The 69 Chilean species are reviewed by Karl Reiche in Engler's Bot. Jahrb. 18:259–306 (1894).

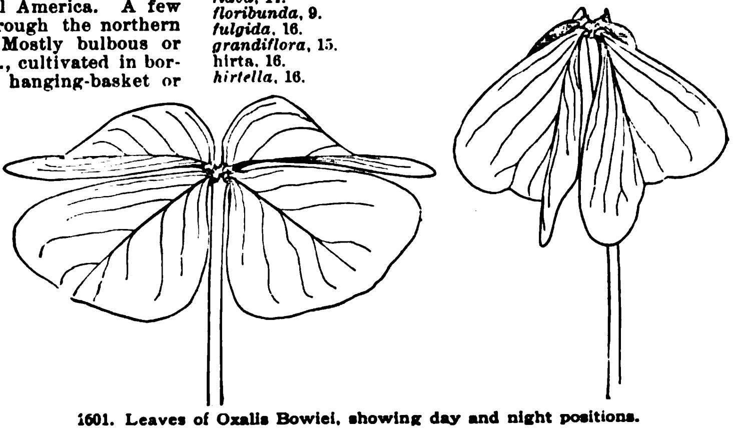
Wm. Trelease.

None of the cultivated kinds are hardy, at least in the North. The bulbous or tuberous kinds grown in greenhouses make handsome pot-plants for autumn and winter decoration. They are also favorite house plants, and one frequently sees them displayed as hanging plants. They are easily grown, clean, healthy, and continue a long time in bloom. The roots are started in August or September, and commence growth quickly. Good rich soil is recommended. The crowns should be kept near the surface, and deep pots used, as the plants are liable to lift themselves out. Abundance of water will be required during the growing season, and a little liquid stimulant will help them when in bloom. When going to rest, less water will be required, until finally the pots may be laid on their sides until another season.

T. D. Hatfield.

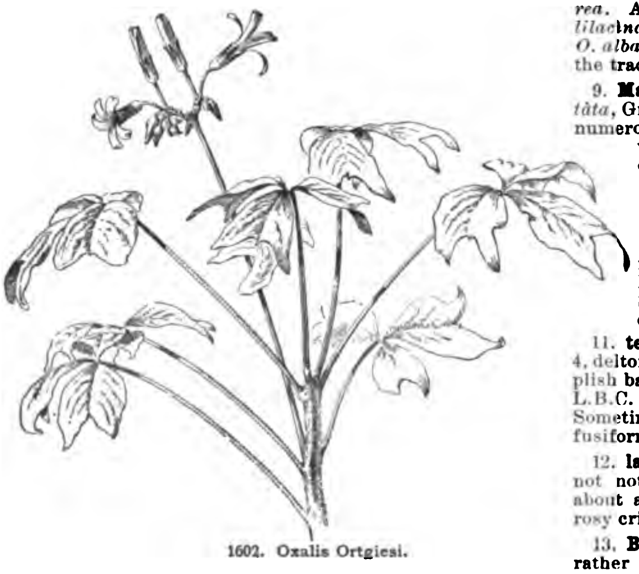
INDEX.

Acetosella, 6.
alba, 8.
arborea, 8.
atropurpurea, 2.
bipunctata, 9.
Bowiei, 13.
caprina, 14.
cernua, 14.
corniculata, 2.
delicata, 5.
Deppei, 11.
elongata, 17.
esculenta, 11.
flava, 14.
floribunda, 9.
fulgida, 16.
grandiflora, 15.
hirta, 16.
hirtella, 16.
Japonica, 7.
lasiandra, 12.
laxula, 15.
lilacina, 8.
lutea, 14.
maritima, 9.
Martiana, 9.
multiflora, 16.
Ortgiesi, 4.
purpurea, 15.
rigidula, 15.
rosacea, 16.
rosea, 1.
rubella, 16.
rubra, 8.
speciosa, 15.
suggillata, 15.
tetraphylla, 11.
tropæoloides, 2.
urbica, 9.
Valdiviana, 3.
Valdiviensis, 3.
variabilis, 15.
venusta, 15.
versicolor, 17.
violacea, 10.



1601. Leaves of Oxalis Bowiei, showing day and night positions.

A. *Plants without bulbs or scaly rootstocks: stem usually elongated, leafy.*
  B. *Lfts. palmately placed, not separated, notched.*
    C. *Color of fls. rosy*........... 1. **rosea**
    CC. *Color of fls. chiefly yellow.*
      D. *Peduncles shorter than lvs*.................... 2. **corniculata**
      DD. *Peduncles longer than lvs.*
        E. *Foliage clustered*...... 3. **Valdiviensis**
        EE. *Foliage scattered*...... 4. **Ortgiesi**
  BB. *Lfts. pinnately placed, somewhat separated, entire*...... 5. **delicata**
AA. *Plants with underground stems thickened and scaly at end, forming a sort of tuber: stem scarcely any: lvs. of 3 lfts.*
  B. *Fls. white, with rosy veins.*
    C. *Lfts. obcordate*.............. 6. **Acetosella**
    CC. *Lfts. broadly triangular, scarcely notched*.......... 7. **Japonica**
  BB. *Fls. rosy, lilac, or white*...... 8. **rubra**
AAA. *Plants from loose, scaly, ovoid bulbs: stem scarcely any: fls. umbelled on elongated scapes. American species.*
  B. *Lfts. 3.*
    C. *Bulb composed of numerous small ones*............... 9. **Martiana**
    CC. *Bulb simple*................10. **violacea**
  BB. *Lfts. 4 or 3*...................11. **tetraphylla**
  BBB. *Lfts. 5–10*...................12. **lasiandra**
AAAA. *Plants from hard, mostly fusiform bulbs: lfts. 3. Cape species.*
  B. *Fls. umbelled: stems scarcely any.*
    C. *Color of fls. rose*............13. **Bowiei**
    CC. *Color of fls. yellow*.........14. **cernua**
  BB. *Fls. solitary on the peduncles.*
    C. *Stem scarcely any: lfts. broad*....................15. **variabilis**
    CC. *Stem distinct, leafy: lfts. narrow.*
      D. *Lvs. nearly sessile*.......16. **hirta**
      DD. *Lvs. mostly long-stalked*.17. **versicolor**



1602. Oxalis Ortgiesi.

1. **ròsea,** Feuil. Stem elongated, erect: lvs. scattered, rather short-petioled; lfts. obcordate: fls. in open, irregularly forked cymes on elongated axillary peduncles, rather large, rosy, with deeper veins. Chile. B.M. 2830. B.R. 13:1123 (as *O. floribunda*). *O. Simsii,* Sweet, scarcely differs, except in its darker red fls. Chile. B.M. 2415 (as *O. rosea*).

2. **corniculàta,** Linn. Slender, prostrate, often rooting, loosely hairy: lfts. obcordate: fls. usually 2 to 3 together, small, yellow.—A tropical form of this polymorphous species is universal as a greenhouse weed, especially in Agave and Cactus tubs.

Var. **atropurpùrea,** Planch. (*O. tropæoloides,* Schlachter). Ascending, tufted, with deep purple-red stems and foliage. Sometimes used for beds or borders, and for carpeting large tubs, etc. Eu. F.S. 12:1205; 19:1968. R.H. 1897, p. 499.

3. **Valdiviénsis,** Barn. (*O. Valdiviàna,* Hort.). Short-stemmed: lvs. clustered, long-petioled; lfts. obcordate: fls. closely umbelled on erect, elongated peduncles, yellow, with reddish veins. Chile.

4. **Órtgiesi,** Regel. Fig. 1602. Stem elongated, erect, rather fleshy and usually reddish: lvs. scattered, often on long, colored petioles; lfts. red below, cuneate, with broad V-shaped notch at end: fls. very short-stalked, in forked cymes on elongated peduncles, small, yellow, with deeper veins. Peru. Gt. 1875:817.

5. **delicàta,** Pohl. Stem erect, elongated, slender, branching: lfts. ovate or lance-ovate, acute: fls. in forked cymes on elongated peduncles, small, pale rose. Brazil.

6. **Acetosélla,** Linn. Wood Sorrel. Rhizome slender, the ends scarcely thickened, densely scaly: lfts. obcordate, not orange-dotted: fls. solitary on the scapes, white, with rosy veins. Eu., N. Amer. Gn. 47, p. 129.—While a charming plant for the wood-garden, this, which is sometimes held to be the original Irish Shamrock, scarcely enters into ordinary gardening. G.C. II. 25:685.

7. **Japónica,** Franch. & Sav. Lfts. broadly triangular, scarcely notched, truncate. Otherwise similar to the last. Japan.

8. **rùbra,** St. Hil. Rhizome thickened at ends into loosely toothed tubers, sometimes nearly an inch thick, and often clustered: lfts. obcordate, more or less hairy, orange-dotted beneath: inflorescence mostly compound: fls. numerous, umbelled, rosy, with deeper veins. Brazil. Gn. 50, p. 511 (as *O. floribunda*).—Usually cult. as *O. floribunda,* which name properly belongs to the next, and sometimes, but also erroneously, as *O. arborea.* A lilac-flowered form passes erroneously for *O. lilacina,* and a white form for *O. arborea,* var. *alba* or *O. alba;* and *O. violacea* and *O. violacea* var. *alba* of the trade seem to be this species and its variety.

9. **Martiàna,** Zucc. (*O. úrbica,* St. Hil. *O. bipunctàta,* Grah. *O. floribúnda,* Lehm.). Bulbs composed of numerous small ones: lfts. obcordate, somewhat hairy, with a marginal row and some scattered dots of orange color beneath: umbels usually compound: fls. rose-purple. Trop. Amer. B.M. 2781; 3938. —By a misprint this is sometimes advertised as *O. maritima.*

10. **violàcea,** Linn. Bulb simple: lvs. rather fleshy, glabrous: fls. in simple umbels, rose-violet. Eastern U. S. B.M. 2215. Mn. 5:121.—Scarcely useful, except for hardy borders, rockeries, etc., and transient.

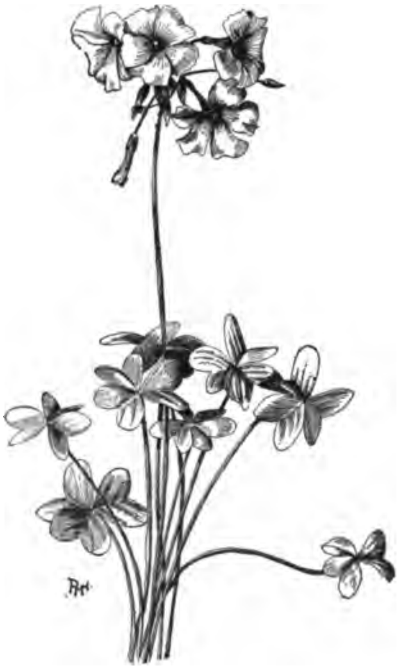
11. **tetraphýlla,** Cav. (*O. Déppei,* Lodd.). Lfts. 3 or 4, deltoid, truncately notched, each crossed by a purplish band: fls. rather few, lilac to deep rosy. Mexico. L.B.C. 8:790; 15:1500. G.M. 39, p. 403. Gn. 8, p. 43.—Sometimes called *O. esculenta,* because of the large fusiform roots beneath the bulbs.

12. **lasiándra,** Zucc. Lfts. 5 to 10, oblong-spatulate, not notched, several inches long, radiately pendent about a reddish disk at end of petiole: fls. crowded, rosy crimson. Mexico. B.M. 3896.

13. **Bòwiei,** Herbert. Fig. 1601. Lvs. large; lfts. rather fleshy, broadly obcordate, deep green: fls. large, loosely clustered, bright rose-red. Cape. B.R. 19:1585. B. 1:25. R.H. 1858, p. 120. Gn. 10, p. 159.

14. **cérnua,** Thunb. Fig. 1603. Lfts. broadly obcordate, deeply notched, often purplish: fls. large, compactly clustered, bright yellow. Cape. L.B.C. 12:1154.

B.M. 237(as *O. caprina*). A double-fld. form naturalized about the Mediterranean is also commonly cult. F.S. 19:1964.—Both the single and double forms are frequently but wrongly listed as *O. lutea* and *O. flava*, and sometimes as *O. caprina*, and the popular name of Bermuda Buttercup is becoming attached to them



1603. Oxalis cernua.

15. **variábilis**, Jacq. (*O. variábilis*, var. *albiflòra*, Lindl. *O. grandiflòra*, Jacq. *O. láxula*, Jacq. *O. purpùrea*, var. *láxula*, Hort. *O. rigídula*, Jacq. *O. suggillàta*, Jacq.). Lvs. large, rather fleshy, sometimes purplish, petioled: fls. large, white or slightly variegated with rose color, yellowish at base. Cape. B.M. 1683.

Var. **rùbra**, Jacq. (*O. purpùrea*, Jacq. *O. speciòsa*, Jacq. *O. venùsta*, Lowe). Fls. rosy to deep rose-purple. Cape. B.R. 18:1505. B.M. 1712.

16. **hírta**, Linn. (*O. rosàcea*, Jacq. *O. multiflòra*, Jacq. *O. rubélla*, Jacq. *O. hirtélla*, Jacq. *O. fúlgida*, Lindl.). Lvs. nearly sessile; lfts. spatulate: fls. from lavender or pale rosy (var. **rosea**) to deep rose color. Cape. B.R. 13:1073. B.M. 1031. L.B.C. 3:213.

17. **versícolor** (*O. elongàta*, Jacq.). Glandular: lvs. and peduncles clustered at end of simple stems; petioles mostly elongated; lfts. linear-wedge-shaped: fls. white, yellowish below, the petals bordered with red, opening only in full sunshine. Cape. B.M. 155. F.S. 8:834.

WM. TRELEASE.

OXÈRA (meaning dubious). *Verbenàceæ.* It needs but a glance at any of the colored portraits of *Oxera coccinea* to show that it is one of the most interesting climbers cultivated in our hothouses. It has ivory-white, trumpet-shaped, sweet-scented fls. 2 in. long and 1 in. across, borne profusely in clusters of a dozen or more. A plant 2 years old from cuttings will completely clothe the rafters and bloom freely, the weight of the clusters causing the fls. to droop gracefully. The prominent calyx reminds one of *Clerodendron Thompsonæ*, a distinguished favorite and near relative. As the cylindrical part of the corolla-tube leaves the calyx it makes a sharp bend and then broadens out into a funnel-shaped flower, with the 4 lobes scarcely spreading. The spirited appearance of the fls. is enhanced by the long style and the 2 stamens, which are thrust out and strongly curved.

Oxera is a genus of 10 species of shrubs, often climbers, all from New Caledonia. Lvs. opposite, entire, leathery: fls. whitish or yellowish, in twice- or thrice-forked cymes, varying greatly in form of calyx and corolla, but the latter always 4-lobed, and wide-throated: drupes 4-parted or by abortion reduced to a single segment.

pulchélla, Labill. Lvs. 2–5 in. long, stalked, the lower ones oblong-lanceolate: calyx conspicuous, loose, composed of 4 more or less united greenish yellow sepals, each ½–¾ in. long. Gn. 33:651; 45, p. 333. I.H. 36:76. J.H. III. 30:33. B.M. 6938. G.C. III. 3:209. R.H. 1890, p. 274.—Once offered by John Saul, Washington, D. C. Also cult. outdoors in S. Calif.

OX-EYE. In America, *Heliopsis;* in Europe, *Buphthalmum*. **Ox-eye Daisy.** *Chrysanthemum Leucanthemum* and *Rudbeckia hirta*.

OXLIP. *Primula elatior.*

OXYÁNTHUS (Greek, *sharp flower;* referring to the acute lobes of the corolla and calyx). *Rubiàceæ.* A genus of 15 species of African trees and shrubs, allied to the Cape Jasmine and to *Gardenia citriodora*. They are remarkable for their extremely long and slender corolla-tubes, which are topped by a 5-pointed star of spreading, narrow lobes. The fls. are sometimes 5–6 in. long, and 2 in. across in cultivation. Lvs. opposite: fls. usually white, in axillary racemes or panicles; calyx-tube truncate, or with 5 short teeth; corolla salver-shaped, throat glabrous; stamens 5, inserted at the mouth of the tube: ovary 2-celled, except in 1 species; style usually exserted; stigma usually spindle-shaped or club-shaped, 2-cut at the top: ovules numerous, not immersed in the 2 fleshy placentæ: fr. a sort of berry. Twelve species are described in the Flora of Tropical Africa, 3 in Flora Capensis.

Natalénsis, Sond. Branches, lvs. and calyx glabrous: lvs. elliptic-oblong or ovate-lanceolate, shortly acuminate, 7–8 in. long, 3 in. wide: racemes axillary, loosely 16–20-fld.: fls. white; corolla-tube about half the length of the lvs. Wet places in woods near Durban, Natal. Cult. outdoors in S. Fla. and in Eu. under glass.

O. tubiflòrus, DC. Hispidulous-puberulous: lvs. obtusely rounded or somewhat eared at the base: fls. 6–7 in. long, at first creamy white, then tawny or ochrous: fr. terete, not grooved. Trop. Africa. B.M. 4636. F.S. 7:737. B.M. 1992 (as O. speciosus).

W. M.

OXYCÓCCUS. See *Vaccinium.*

OXYDÉNDRUM (Greek, *sour tree;* from the acid taste of the foliage). Also written *Oxydendron*. *Ericàceæ.* SOUR-WOOD or SORREL-TREE. A genus of one species, a North American tree 15–40 ft. high, bearing numerous small white tubular fls. in early summer. Its chief beauty lies in the character of its inflorescence (see Fig. 1604), which is a panicle composed of 6 or more racemes, each about 3–6 in. long and bearing as many as two dozen pendent fls. It is also valued for its highly colored autumn foliage. It is of rather slow growth and is useful in shrubberies, along the borders of woods, or even within the woodland, since it endures shade fairly well. It is of easy culture in any moderately good soil, but rather slow in becoming established.

This tree is one of many known to nurserymen as Andromedas. The prevailing tendencies among botanists to-day distribute these species in many different genera, leaving only *A. polifolia* in Andromeda as strictly defined. *Andromeda arborea* is made a monotypic genus called Oxydendrum, based on the following characters: calyx cut into 5 separate sepals which overlap more or less in the young buds: corolla ovoid-cylindrical, crowned with 5 short teeth: anthers long, linear, blunt on the back, opening by long chinks down the front: capsule woody; seeds numerous, needle-shaped.

arbòreum, DC. (*Andrómeda arbòrea*, Linn.) SOUR-WOOD. SORREL-TREE. Fig. 1604. Smooth-barked tree attaining a maximum height of 60 ft., with trunk 15 in. thick: lvs. deciduous, membranous, oblong or lanceo late, 3–6 in. long, glabrous, veiny, slender-stalked: clusters borne on leafy shoots of the season: fls. opening slowly. Rich woods, Pa. and Ohio, along the Alleghenies to Fla. B.M. 905. B.B. 2:571. S.S. 5:235.

F. W. BARCLAY and W. M.

1604. Sour-wood or Sorrel-tree, Oxydendron arboreum (X ⅛).

OXYLÒBIUM (Greek, *sharp pod*). *Leguminòsæ.* This is one of many genera of Australian shrubs with pea-like fls. which are little known in cultivation. For winter bloom under glass none of them equals *Cytisus Canariensis.* Oxylobium is a genus of 28 species, of which perhaps a dozen have been cult. in Europe. Their fls. are yellow, or more or less flushed with red on the keel or the base of the standard. *O. Callistachys* is perhaps the best for conservatories. In America it is cult. only in S. Calif.

Generic characters: lvs. very short-stalked, opposite or more or less whorled, rarely scattered or alternate: fls. in terminal or axillary racemes; petals clawed; stamens free: ovary villous, sessile or stalked, 4–30-ovuled. Nearest to Chorizema, but the keel is about as long as the wings, while in Chorizema the keel is much shorter. The following species was considered the type of another genus; it is distinguished from all other species of Oxylobium by the incomplete dehiscence of the pod. See Flora Australiensis 2:14 (1864).

Callistachys, Benth. Tall shrub: lvs. mostly in irregular whorls of 3, varying from ovate-oblong and 1½–2 in. long to lanceolate and 4–5 in. long, leathery, silky-pubescent beneath when young: racemes oblong or pyramidal, 2–6 in. long. B.R. 3:216 (as *Callistachys lanceolata*). B.M. 1925 (as *C. ovata*). P.M. 8:31 (as *C. longifolia*). L.B.C. 20:1983 (as *C. retusa*). J.H. III. 35:35.

OXYPÉTALUM (Greek, *sharp petal*). *Asclepiadàceæ. O. cæruleum* is a tender twining herb from the Argentine Republic with changeable 5-lobed fls. about an inch across. The fls. are said to be pale blue when they first open, then purplish, and when withered lilac. Not cult. in America, but apparently desirable for cultivation here. The following are perhaps obtainable from Europe: *O. appendiculatum,* with pale yellow, fragrant fls.; *O. Banksia,* with purple fls., and *O. solanoides,* blue, tinged rose.

Oxypetalum is a genus of about 50 species, mostly South American and largely Brazilian herbs or sub-shrubs, twining or not: lvs. opposite: calyx 5-parted: corolla deeply 5-cut, short-tubed: scales of the corona 5, fastened at the base of the corolla and staminal tube.

cærùleum, Dcne. Downy: lvs. short-petioled, oblong, one of each pair of the upper lvs., 3–4-fld.: corolla-lobes but cordate-hastate at the base: peduncles axillary from spreading: scales of the corona 5, erect, darker blue, fleshy, exserted, recurved and notched at the apex. B.M. 3630 (*Tweedia versicolor*).

OXÝTROPIS (Greek, *sharp keel*). *Leguminòsæ.* Three Colorado wild flowers are offered under this name. The fls. are pea-shaped, borne in spikes, and range from white through blue and purple to crimson. The plants are tufted, and the lvs. are odd-pinnate, have 7–16 pairs of lfts., and are often woolly white beneath. *O. Lamberti* is one of many plants that have been charged with being the "Loco weed" which ruins western horses. This genus, according to E. L. Greene (Pittonia 3:208), should be referred to Aragallus. Aragallus is reviewed in Erythea 7:57–64 (1899), but the genus is not defined. It is closely related to Astragalus, and differs essentially in the pods being usually 2-celled instead of 1-celled. About a dozen kinds of Old World Oxytropis said to be cult. in Europe, mostly in rockeries. They are hardy, easily prop. by seed or by division, and prefer a dry, sandy loam. These plants are of very minor value horticulturally.

A. *Stipules free: pod 1-loculed.*

defléxa, DC. (*Aragállus defléxus,* Heller). A foot or less high: lfts. crowded in 12–16 pairs, lanceolate to oblong, 3–6 lines long: fls. about 3 lines long: pod 1-celled. Mts., Brit. Amer. to Colo. and Utah.—Very distinct species, by reason of its stipules.

AA. *Stipules adnate to the petiole: pod 2-loculed.*

Lámbertii, Pursh (*Aragállus Lámberti,* Greene). Lfts. about 7 pairs, 4–16 lines long: spike sometimes short-oblong, densely fld., often long and sparsely fld.: fls. 1 in. across, typically purple or violet; calyx not inflated, distinctly surpassed by the mature pod: pod turgid but not membranous-inflated, more or less leathery, subterete, neither glandular nor viscid, imperfectly 2-loculed or less. Common on the prairies. B.M. 2147 (dark blue). B.R. 13:1054 (blue). V. 3:138.—Aven Nelson, in Erythea 7:62, says that the species should be restricted to the purple- and violet-fld. forms. D. M. Andrews offers a crimson-fld. form, and also var. **spicàta,** which has large spikes of white fls.

W. M.

OXYÙRA. See *Layia.*

OYSTER PLANT or SALSIFY. *Tragopogon porrifolius.*

P

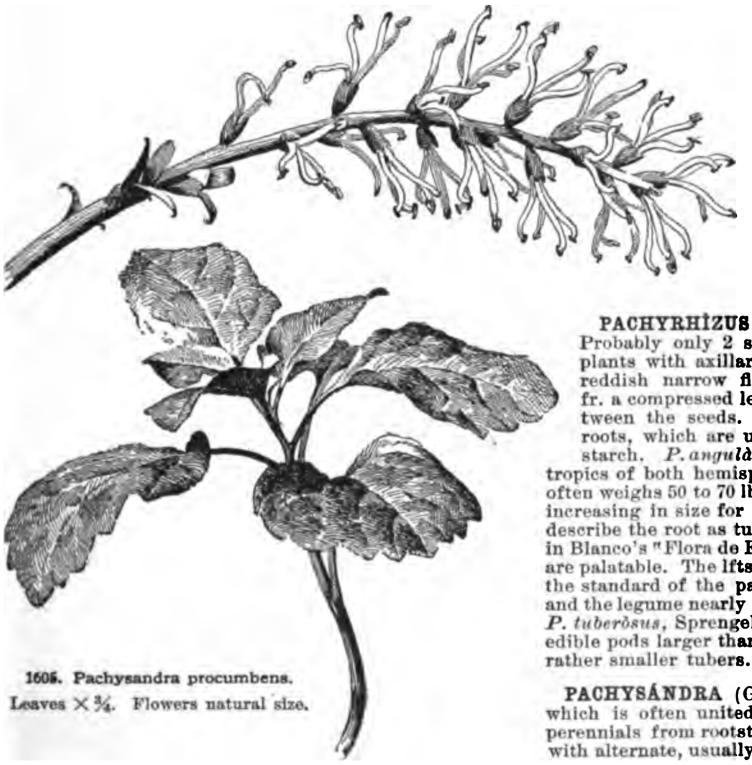
PACHÌRA (native Guiana name). *Malvàceæ.* A genus of about 30 species of tropical American trees with odd and showy flowers. The fls. may have a spread of 9 inches. Their chief beauty is their immense mass of stamens; but their petals are also striking. These are very long and narrow, e.g., 6x1 in., and gracefully recurved, with wide spaces between. The finger-shaped foliage also gives the trees a distinct appearance. Pachiras are all natives of South America, except 2 species which are found in Mexico and 2 in the West Indies. One is offered in S. Fla. The others here mentioned have been cult. under glass abroad, but as a group Pachiras are not suitable for conservatory culture, because they grow too high and require too many years' growth before they flower. They are of easy culture in a warmhouse and grow rapidly. Sometimes called Silk Cotton Trees.

Generic characters: lvs. palmate, cup-shaped, truncate or sinuate: column divided above into very many filaments: petals downy outside: capsule 5-celled, loculicidal: seeds many, glabrous. Pachira's nearest allies are Adansonia (the baobab tree) and Bombax, both of which are cult. Bombax differs from the other two genera in having its capsule densely woolly inside. Adansonia has a 5-cut calyx, while in the other two genera the calyx is truncate.

aquática, Aubl. Lfts. glabrous, 5–9 (usually 5), elliptic-oblong, obovate-oblong, or elliptic-lanceolate, subsessile: calyx truncate, warty-wrinkled; petals 8 in. long, 6–8 lines wide, greenish white: column divided above into 10 paired outer and 5 inner bundles of filaments, each forking and bearing 10–30 stamens in pairs: color of filaments yellowish purple: stigma obscurely 5-lobed. Trop. Amer., West Indies.

P. álba, Walp. Less desirable because it flowers at a time when the tree has no foliage. Petals yellowish white inside: filaments white. Winter. Brazil (or New Granada?). B.M. 4508. L.B.C. 8:752 (as Carolinea alba). Odor powerful and somewhat unpleasant.—*P. insignis*, Savign. Petals crimson: filaments white. Mex. L.B.C. 11:1004 (as Carolinea insignis). Fragrance powerful. Fruit said to be as large as a child's head; the seeds of the size, appearance and taste of chestnuts. —*P. longifòlia*, Walp. Evergreen, and has flowered under glass at a height of only 4 ft. Petals white: filaments yellow below, red above. Mex. B.M. 4549.—*P. macrocárpa*, of Nicholson's Dict. Gard. (not of Walpers), seems to be P. longifolia.—*P. minor*, Hemsl. Petals much narrower than in the others here described, and green: filaments red. Mex. B.M. 1412 (as Carolinea minor).

W. M.



1606. Pachysandra procumbens.
Leaves × ¾. Flowers natural size.

PACHÍSTIMA (said to be derived from Greek, *pachys*, thick, and *stigma;* alluding to the slightly thickened stigma; spelled also *Pachystima* and *Pachystigma*). *Celastràceæ.* Low evergreen shrubs with small opposite lvs. and inconspicuous reddish fls. in the axils of the lvs.: fr. a small oblong capsule. They are hardy with slight protection in the Arnold Arboretum, Boston, and are handsome dwarf evergreens for rockeries or rocky slopes, but still rare in cultivation. They seem to grow in any well-drained soil and prefer sunny positions. Prop. by seeds or by layers; also by cuttings of half-ripened wood under glass. Two species in the mountains of North America, allied to Euonymus. Branches somewhat quadrangular, verrucose: lvs. with minute stipules: fls. perfect, small, in few-fld. axillary cymes; calyx-lobes, petals and stamens 4: ovary 2-celled, usually only one cell developing into a small, oblong, 1-seeded capsule.

Myrsinites, Raf. (*Myginda myrtifòlia*, Nutt. *Oreóphila myrtifòlia*, Nutt.)., Spreading shrub, to 2 ft.: lvs. broadly elliptic to oblong-obovate, slightly revolute at the margin and serrulate or almost entire, ½–1 in. long: fls. short-stalked, reddish: fr. about ⅓ in. long. May–July. Brit. Col. to Calif. and North Mex.—Resembles the small-leaved form of *Euonymus radicans*, but of more rigid and stiff growth.

Cánbyi, Gray. Dwarf shrub with trailing and rooting branches: lvs. narrow-oblong, occasionally obovate, revolute and usually serrulate above the middle, ⅓–¾ in. long: fl.-stalks filiform, longer than half the leaf: fls. reddish. April, May. Mts. of Va. Meeh. Nat. Flow. I, 1:44.—This is somewhat similar in habit and foliage to *Euonymus nanus*, but less vigorous. Sometimes called Rat Stripper.

ALFRED REHDER.

PACHYRHÌZUS (*thick-rooted*). *Leguminòsæ.* Probably only 2 species. They are strong twining plants with axillary fascicles or racemes of blue or reddish narrow fls. and 3-foliolate, pinnate lvs.: fr. a compressed legume, with depressed spaces between the seeds. They bear very large tuberous roots, which are used for food and as a source of starch. *P. angulàtus*, Rich., is widely spread in the tropics of both hemispheres. The thick tuberous root often weighs 50 to 70 lbs., and attains a length of 6–8 ft., increasing in size for four or five years. Some writers describe the root as turnip-shaped, and it is so figured in Blanco's "Flora de Filipinas." When young, the roots are palatable. The lfts. of this species are 3–4 in. across, the standard of the papilionaceous fls. roundish ovate, and the legume nearly smooth, straight, 6–9 inches long. *P. tuberòsus*, Sprengel, is tropical American, producing edible pods larger than those of *P. angulatus*, and with rather smaller tubers.

L. H. B.

PACHYSÁNDRA (Greek, *thick stamen*). *Buxàceæ*, which is often united with *Euphorbiàceæ.* Prostrate perennials from rootstocks, 6–12 in. high, scaly below, with alternate, usually deeply toothed, evergreen or deciduous, 3-nerved broad lvs. above: spikes staminate above, with a few pistillate fls. at the base of each: staminate fls. with 4 sepals and stamens and a rudimentary pistil; sepals variable in number in the pistillate flowers; petals none; pistil 3-celled, 2 ovules in each cell: seeds smooth. Two species known; of low and dense growth. Very early flowered and attractive to bees. Of little value in gardens except for the masses of bright green lvs. Easily prop. by division in ordinary soils. Good for rockeries.

procúmbens, Michx. MOUNTAIN SPURGE. Fig. 1605. With spikes of white or purplish fls. from the base of the stems. March–May. W. Va. to Fla. B. M. 1964. L.B.C. 10:910. B. R. 1:33.

terminàlis, Sieb. & Zucc., has the small spikes of whitish fls. terminal, and the lvs. obovate-cuneate; dwarf. May. Japan. Var. **variegàta,** Hort., with white variegated lvs., is in the trade.

P. coriàcea, Hook., cult. in Europe, is referred to Sarcococca.

J. B. S. NORTON.

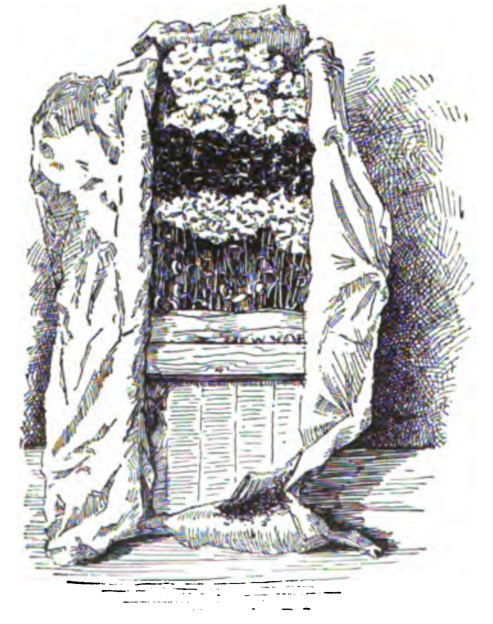
P. procumbens is, in the vicinity of Boston, deciduous, and is only desirable from the feature of its curious flowers borne so extremely early in the spring. The foliage is of a dingy color and deciduous, whereas *P. terminalis* is a true evergreen with thick, glossy foliage forming a dense mat, making a very desirable low-growing cover plant, succeeding admirably either in full sun or partial shade. The variety *variegata* is a very choice cover plant for ornamental effects.

J. WOODWARD MANNING.

PACHÝSTIMA. See *Pachistima.*

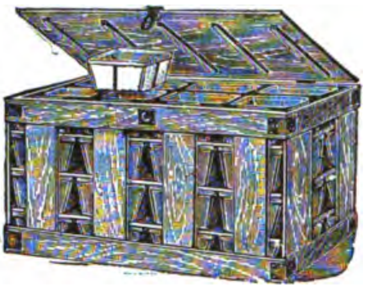
PACKAGES. See *Packing.*

PACKING. The operation of placing fresh fruits and vegetables, cut-flowers or living plants in suitable baskets, boxes, barrels or bales for safe transportation. (The term is also sometimes used for the process of canning or preserving cooked fruits and vegetables when done on a commercial scale.) The term is especially employed when perishable horticultural products are prepared for long shipment. Much of the value of such products for distant markets depends on proper packing. With transported nursery stock of all kinds the life of the plants depends on it, while with fruits, vegetables and cut-flowers the attractiveness and salability of the product are very largely determined by the care and judgment with which the goods are packed.



1606. Packing of cut-flowers.

The requisites for the proper packing of living plants are: (1) that the roots be protected from injurious drying by a covering of some damp material, (2) the partial exclusion of the air, and (3) that ventilation be sufficient to prevent the heating of the contents of the package. Bog moss (sphagnum) is the material commonly used to prevent the drying out of the roots. Moistened hay, straw, chaff, planer shavings, or other similar material is sometimes substituted for the moss, or used in connection with it.



1607. Berry crate, holding 32 boxes.

Small plants, as strawberries, cabbages, etc., are often packed upright, one layer deep, in light, paper-lined baskets, with the roots bedded in moist sphagnum, the plants being crowded together so closely as to prevent undue drying. Small plants in pots may be shipped in the same way, or, if the time occupied in transit does not exceed 3 or 4 days, they may be knocked from the pots and wrapped in paper with the ball of earth still adhering to the roots. Paper pots are also manufactured for this and other purposes. These paper bundles are then placed in any convenient box or crate.

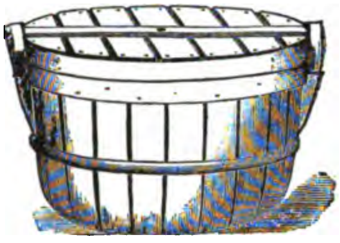
Fruit trees and most other dormant nursery stock are packed in large boxes, or in bales covered with straw and bagging, enough sphagnum and other packing material being used to keep the contents slightly moist. Large shipments of nursery stock are often made by packing in bulk in the car, thus saving the expense of boxes.

Cut-flowers are necessarily perishable, but the kinds most used by florists may be kept in good condition for several days if they are so packed as to avoid crushing and to maintain a cool, water-saturated atmosphere. This condition is best secured by placing the flowers a single layer deep, in light, shallow boxes or trays that are placed one on top of another and strapped together for shipment. Each tray is lined with a sheet of oiled paper large enough to fold over the top and to protect the contents from drying. Sufficient moisture is secured by using damp paper for packing about the stems. A cool temperature is essential, and should be secured by refrigeration if necessary. Fig. 1606.

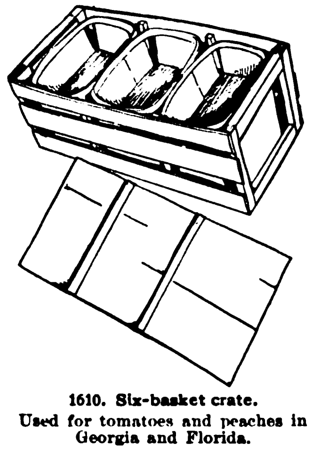
1608. Delaware peach basket.

The methods of packing fruits and vegetables necessarily differ widely with the nature of the articles to be packed, and for the same product custom often has established different practices in different parts of the country. Formerly, it was the habit in many markets to return empty packages to the shipper, so that they could be used over and over again. With the vast increase in distant shipments, due to improved transportation facilities, this became impossible, and now cheap gift packages intended to be used but once are coming into favor and in some regions are used exclusively.

For berries of all kinds, and other small fruits, quart boxes or baskets, made of thin veneers fastened together with tacks or with wire staples, are generally used, though pints and even smaller sizes are popular in some markets, especially for such delicate fruits as raspberries. Square baskets, a little larger at the top than at the bottom, are preferred at the East, while in the Mississippi valley the square "Hallock" or oblong "Leslie" boxes are mostly used. In either case a certain number, usually either 16, 24 or 32, are placed in light slat crates for shipment. Fig. 1607. The boxes or baskets are filled in the field by the pickers. They are inspected more or less thoroughly at the packing house, where the process of packing usually consists in arranging the top layers so that the box or basket shall be evenly, but slightly, rounding full, so as to avoid crushing, and yet not seem slack-filled on reaching market. In some cases, notably in Florida, the boxes are emptied and repacked from the bottom.



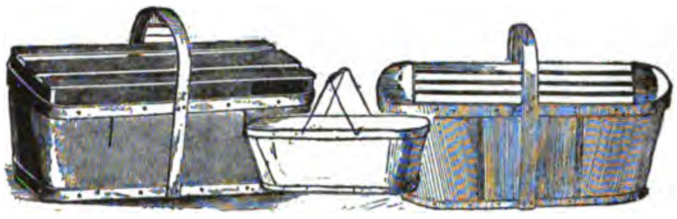
1609. Bushel basket with cover.



1610. Six-basket crate.
Used for tomatoes and peaches in Georgia and Florida.

Peaches are regularly marketed in a greater variety of packages than any of our fruits. In Georgia and neighboring southern states, a light crate holding 6 4-quart baskets is used. In Delaware and throughout the peninsular region, a round, rather deep basket holding five-eighths of a bushel is used. Fig. 1608. It has no handle and usually no cover, and cars have to be specially shelved for carrying it. In New Jersey, the Hudson River country, and New England, a similar basket is used, but holding only 16 quarts. In Michigan custom varies, but the bulk of the shipments are in long, flat-handled baskets of various sizes — quarter, third, and half bushel. The fruit is usually covered with colored netting, and it is sometimes further protected by slat covers. Another Michigan package is a rather heavy, round bushel basket, with small side handles and a stout cover, held in place by a projecting slat that is sprung under the handles. Fig. 1609. In southern Illinois and the Mississippi valley generally, the popular package was for many years a third-bushel box with sawn ends and middle-piece 5 x 8 in., with veneer sides 22 in. long. Of late years it has been replaced, to some extent, by 4-quart baskets like those used in Georgia, but packed one layer deep in 4-basket crates. California peaches always come in rectangular 20-pound boxes, each fruit carefully selected and wrapped in paper. With the larger of these packages, like the bushel and five-eighths bushel baskets, the act of packing consists, as with strawberries, in simply arranging the top so as to secure the desired fulness, but with the smaller packages it becomes a rather difficult art to so place each fruit that the package shall be full, and yet have none of the top layers stand high enough to be crushed by the cover. If the fruits chance to run of just such size that the package can be evenly filled by packing in uniform layers, one on top of another, the problem is comparatively simple. Thus, with the Georgia 4-quart basket, some of the small early kinds, like Tillotson, often run so that three layers deep just fills the basket properly. Again, with the largest Elbertas, two layers, one on top of the other, are sufficient, but the great bulk of the crop will not pack on either of these plans, and it is necessary to introduce a broken layer between the bottom and top layers. Such packing requires skill and experience in order to produce satisfactory results. When the fruits run unevenly in size they must be assorted or they cannot be packed conveniently. It is slower and more expensive than simply dumping the fruit into large baskets, but delicate fruits, like peaches, endure distant shipment much better in small than in large packages, and experience is constantly demonstrating that extra care in assorting and packing fruit is always well paid for by increased market prices.

All of these packages, or modifications of them, are also used for plums, pears, early apples, tomatoes and many other products. Which one to select for use in any given case will depend on the character of the product, the distance from market, the available supply of skilled labor and on the usages and preferences of the market to be supplied. The latter is an important factor and one that sometimes changes in the same market with different seasons of the year. Thus, with tomatoes in Chicago and other western markets, the supply early in the spring is largely from Florida, where the custom is to pick green, wrap in papers and pack in the Georgia 6-basket crate. Fig. 1610. This style of package and of packing now dominates the market and is the recognized standard for tomatoes during March and April. During the last of May and first of June, Mississippi tomatoes begin to appear in these markets in increasing quantities. These are packed without wrapping, in flat 4-basket crates. Being fresher than the Florida stock, they are preferred by the trade, and from this time on wrapped tomatoes in 6-basket crates are distinctly at a discount, even if of good quality.



1611. Forms of Climax baskets.

Grapes are likewise marketed in a variety of packages. At the South they are often shipped in the 6-basket crate. Fancy kinds are sometimes packed in round 3-pound boxes that are crated for shipment. The great bulk of the grape crop outside of California is, however, packed in 5–10-pound Climax baskets. Fig. 1611. These are oblong baskets with a handle. They are made with sawn bottoms and solid veneer sides, with a solid veneer cover fastened down with wire hooks. California grapes are packed in square 5-pound baskets made of two pieces of thin veneer crossed over the bottom, and bent up to form the sides, with the top ends of the veneer held in place by a light tin binding. Four, or sometimes eight, of these baskets are placed in a crate, making a 20- or 40-pound package. In many places, the grapes are cut from the vines some hours in advance of packing, so that the stems may lose their brittle freshness and become limp enough to lie close together, thus preventing undue shrinking in transit. Each bunch is carefully examined and all imperfect berries are removed with sharp-pointed clippers. The packer should incline the basket in such a way that the packing may begin in one end, thus allowing the top, or face, to be made of the smoothly overlapping tips of the clusters with no stems showing.

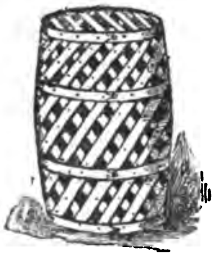
Pears at the East are packed in barrels, half barrels or kegs, or in some of the various peach packages. In California they are all wrapped in paper and are carefully packed in 40-pound boxes.

Until within the last few years the barrel was the almost universal apple package, and it is still used for handling the great bulk of the crop. Early, perishable kinds have, however, long been shipped in the various peach packages. Recently, the growers of the Pacific coast have led the way in packing winter apples in boxes. They are wrapped after the manner of California pears. Some eastern growers are finding it to their advantage to follow this western fashion for their fancy fruits, and it seems probable that the better grades of apples at least will come more and more to be marketed in smaller packages. In Boston, a bushel box is now popular for apples and other products. Fig. 1612. In packing apples in barrels it is customary to place the first one or two layers by hand, turning the stem ends all down. This is called facing. The barrel is now filled, a basketful at a time, by lowering the basket into the barrel and carefully turning out the fruit. The barrel is shaken occasionally so as to settle down the fruit, and when the top is reached it is rounded up enough so that the head has to be pressed into place with considerable force, a long lever or a special barrel press being used for the purpose. The barrel is now turned over, and what was the bottom is marked as the top, so that the hand-laid "face" may be exposed on opening. For vegetables, various open-work or ventilated barrels are in use. Fig. 1613.

1612. A bushel box. Useful for fruits and vegetables.

The requisites for the proper packing of any fruit or vegetable are: (1) that the package selected be inexpensive, attractive, favorably known in the market, and suited to carrying the given product in good condition; (2) that great care be taken in assorting, so that only goods of one even quality go in each package; (3) that skill be used in so placing the goods that the package is evenly and solidly filled, thus preventing the shifting and chafing of the contents in transit and yet avoiding crushing by undue pressure; (4) that while an attractive display of the contents is not only allowable but highly desirable, no attempt at misleading as to the nature of the contents is permissible. Nothing in the past has done more to break down prices and curtail the sales of horticultural products than the pernicious habit of dishonest packing. This fact is now fully recognized by all progressive growers.

F. S. Earle.



1613. Ventilated barrel.

Packing Flowers.—While flowers should not be crushed by being crowded in shipment, it is more often that damage is done by their being too loosely packed and being able to move and shake against one another. In this way the petals are often damaged. The Harrisii and Longiflorum lilies, in fact all the true lilies, are the most difficult of all flowers to pack. They should be so packed that no part of the flower will touch either bottom, top or sides of the box. Several dozen spikes can be tied together and if the flowers are closely interwoven they will do no harm to each other as they will all move together. If this plan is not followed then they must be entirely enveloped in cotton batting.

Orchids, particularly of the Cattleya type, are difficult to pack but travel finely if each spray is fastened to the bottom of the box. Wrap a piece of soft paper around the stem and fasten to the bottom of the box with a small staple

The highest grade of roses, especially of the light-colored varieties, should be wrapped, each flower being in a piece of soft tissue paper. It arrests development of the flower and prevents injury to the outer petals.

The finest blooms of carnations, commanding a high price, should not be tied in bunches of 25, as we have been accustomed to do with cheap flowers. The petals are easily crushed and the flowers have to be kept several hours in water before they assume their perfect form. These fine flowers should be laid in layers with a roll of paper between each layer. Good and perfect packing will always be rewarded with the highest price for the product.

William Scott.

PÆDÈRIA (Latin, *pædor*, bad smell; referring to *P. fœtida*). *Rubiàceæ.* Fourteen species of tropical shrubby twiners, mostly natives of India, Burma and the Malay Archipelago, but one from Madagascar and one from Brazil. *P. fœtida* is cultivated by G. W. Oliver at the U. S. Botanic Gardens, Washington, D. C. Oliver writes ("Plant Culture," p. 76) that it is "usually grown as a stove and greenhouse climber, but it is hardier than is generally supposed. It is rather an attractive-looking but not free-blooming vine. The leaves, or any part of the plant, when bruised emit a most offensive odor. Cuttings should be put in any time after the growths are matured."

Pæderias are slender plants: lvs. opposite, rarely in whorls of 3, petioled: fls. in axillary and terminal dichotomous or trichotomously branching panicled cymes, bracteolate or not; corolla tubular or funnel-shaped; throat glabrous or villous; lobes 4–5, valvate, with inflexed, crisped margins, tip often 3-lobed. Distinguished from allied genera by the 2-locular ovary and 2 capillary, twisted stigmas.

fœ́tida, Linn. Glabrous or nearly so: lvs. opposite, long-petioled, ovate or lanceolate, base acute, rounded or cordate: cyme branches opposite: fr. broadly elliptic, much compressed; pyrenes black, with a broad pale wing, separating from a filiform carpophore.

PÆÒNIA (after the mythical physician Paeon). *Ranunculàceæ.* Peony. Piney. Pæony. Peonies are among the dozen commonest and best hardy herbaceous perennials. There is also one shrubby species, *P. Moutan*, called the Tree Peony. Natives of Europe and Asia, only a single species, *P. Brownii*, being found in North America, on the Pacific coast. Roots thickened to form upright rootstocks: lvs. large, alternate, pinnately compound or dissected: sepals 5, persistent; petals conspicuous, broad, 5–10, but doubling may take place in any species by the numerous stamens becoming petals: carpels 2–5 on a fleshy disk; follicles dehiscent; seeds large, fleshy. Common garden forms are shown in Figs. 1614, 1615. Extended accounts of the genus are by J. G. Baker in Gard. Chron. II., 21:732; 22:9 (1884), and R. I. Lynch, in Journ. Royal Hort. Soc. 12:428 (1890). A botanical monograph by E. Huth, occurs in Engler's Jahrbücher, Vol. 14 (1891). According to Peter Barr, every species mentioned in Index Kewensis has been introduced to cultivation in Europe, except *P. obovata*, a native of Manchuria, which Mr. Barr hopes to obtain by a personal visit to China.

K. C. Davis.

1614. A good clump of Peony.

Peonies are rarely attacked by any insect, animal or fungous disease, neither do they require any covering during the severest weather: in fact, they are among the most hardy, showy, and easily grown of all the garden flowers. In delicacy of tint and fragrance, the Peony more nearly approaches the rose than any other flower. The old-fashioned early red "piny," cultivated since the time of Pliny, is still a favorite in our gardens. Nearly all of the one thousand or more named double varieties grown at present have been obtained by crossing the various forms of *P. albiflora* and *officinalis*. In 1855 only 24 double varieties were known. The single-flowering sorts are not so popular as the double ones, for they do not keep as long when cut and fade more rapidly when on the plant.

Soil.—Peonies grow in all kinds of soil, but do best in a deep, rich, rather moist loam. A clay subsoil, if well drained, is very beneficial when blooms are desired, but the tubers ramify more in lighter soil if grown for propagating purposes. In preparing the bed trench the soil thoroughly two or more feet deep, working in a great quantity of good rich cow manure, as the plants are gross feeders. The ground should be kept well tilled, and an annual top-dressing put above the plants in November; this should be forked into the soil the next spring. Peonies should have a liberal supply of water at all times, and especially while in bloom. Liquid manure, when applied during the growing season and at a time when the ground is dry, gives good returns, both in the growth of the plant and size of the bloom.

Planting.—The crowns should be set 2 inches below the surface. In transplanting, it is a good idea to remove all the old earth so as to start with fresh, unimpoverished soil next to the roots. The flowers produced on small divided plants are likely to be imperfect, but when thoroughly established a plant will continue to bloom if undisturbed for upwards of twenty years. During the period of blooming an inconspicuous wire support is desirable, as a heavy rain often beats down the flowers.

Grouping.—The host of ancient and modern varieties available, ranging from purest white to deepest crimson, in such a diversity of form and size, afford great opportunity for the carrying out of extensive color schemes. Peonies do well in partial shade, which prolongs and intensifies the color of the bloom, and therefore can be used to advantage to brighten up somber nooks. The period of blooming for herbaceous Peonies ranges from the middle of May through the month of June. They grow from 1-3 feet high, and are therefore suitable for planting in front of shrubbery, along driveways, and are especially pleasing when entering into a distant vista. When planted in a border with fall-blooming perennials, such as phlox, funkia, etc., their rich glossy foliage is very effective.

1615. Single Peony (×⅓).

1616. Pæonia albiflora.

Forcing.—Lift the plants in October and place in a coldframe where they will be accessible when the time for forcing arrives. When brought under glass, a uniform temperature of 55° to 60° should be maintained. By feeding well with liquid manure, strong blooms can be produced in eight weeks. A two-years' rest is necessary for the plants before being forced again. To secure extra fine blooms on double-flowering varieties, remove the lateral buds as soon as formed. When the first lateral bud is retained instead of the terminal one, a later period of blooming is obtained. The old flowers should be cut off, so that no unnecessary seed follicles will be formed, and thereby exhaust the plant. It is also important to remove the faded foliage on all Peonies in November, so that it may not interfere with the next season's shoots.

There are three methods by which Peonies are propagated: by division of roots (the most prevalent), by grafting, to increase rare sorts, and by seeds, to obtain new varieties.

Division of Roots.—This is the easiest and most satisfactory method. The roots may be lifted and divided any time from the middle of August until the stalks appear again in the spring. The best time, however, is in the early fall, when the cut surfaces soon callus over and new rootlets form before the frost sets in. Take a large stool, cut off the leaves and separate into as many divisions as can be made with an eye to each tuber. In digging, care should be taken that all of the tubers are dug up, for if not they may remain dormant a season and then produce a shoot, giving rise to the many stray plants which are frequently found in old beds. Tubers divided without an eye should also be planted, as they often act in a similar manner and make a showing above ground in two years' time. Peonies, like most tuberous plants, when dormant stand considerable exposure and can be shipped long distances with safety.

Grafting.—This method is resorted to in herbaceous Peonies when new and rare varieties are to be rapidly increased. An eye of the desired sort is inserted into the tuber of some strong-growing variety, from which all the previous eyes have been removed. This operation is generally performed in August. They should be placed in frames for the winter and transplanted the next year into nursery rows.

Seeds.—Propagating by seed is somewhat tedious, and is only resorted to for increasing distinct species and for obtaining new varieties by hybridization. The seeds should be gathered as soon as ripe and kept damp until sown in November. A mulch during the first season will keep the ground moist and prevent weeds from growing. Generally two years are required for the seed to germinate and three more before a well-developed bloom can be expected.

WM. A. PETERSON.

INDEX.

alba-plena, 6.
albiflora, 3.
amaranthescens, 8.
Andersouii, 10.
anemoneflora, 6.
anomala, 5.
arborea, 1.
arietina, 10.
atrorubens, 6.
Banksii, 1.
Baxteri, 10.
blanda, 6.
Blushing Maid, 8.
Brilliant, 8.
Brownii, 2.
Byzantina, 8.
Californica, 2.
Chinensis, 3.
compacta, 8.
Cretica, 10.
Crown Prince, 10.
decora, 7.
Diogenes, 10.
Double Anemone-fld. Red, 6.
Double Anemone-fld. Rose, 6.
edulis, 3.
elatior, 7.
Excelsior, 10.
Exquisite, 8.
festiva, 3, 6.
fimbriata, 9.
flore-pleno, 4.
fulgida, 6.
Gertrude Jekyll, 7.
hybrida, 4.
insignis, 5.
intermedia, 5.
lobata, 6.
Matador, 10.
Monte Gear, 7.
Moutan, 1.
Northern Glory, 10.
officinalis, 6.
Old Double Red, 6.
Old Double Rose, 6.
Old Double Flesh-White, 6.
Otto Frœbel, 6.
Pallasii, 7.
papaveracea, 1.
paradoxa, 9.
Penelope, 10.
peregrina, 8.
pulcnerrima, 8.
Purple Emperor, 10.
Reevesiana, 3.
Reevesii, 3.
rosea, 6.
rosea-superba, 1.
Rosy Gem, 10.
rubra-plena, 1.
Ruby Queen, 8.
Sabini, 6.
Seraph, 8.
Sinensis, 3.
Sunbeam, 6.
tenuifolia, 4.
vittata, 1.

A. *Plants shrubby: disk enveloping the base of the carpels* .... 1. **Moutan**
AA. *Plants herbaceous: disk not produced to envelop the base of the carpels.*
  B. *Petals short and leathery, scarcely exceeding the sepals* .... 2. **Brownii**
  BB. *Petals not leathery, large and expanding, much exceeding the sepals.*
    C. *Follicles and plant quite glabrous* .... 3. **albiflora**
    CC. *Follicles tomentose, erect or slightly spreading.*
      D. *Lvs. and stem glabrous throughout.*
        E. *Lfts. finely dissected* .... 4. **tenuifolia**
        5. **anomala**
        EE. *Lfts. not so finely divided*.. 6. **officinalis**
      DD. *Lvs. and stem pubescent in the upper part.*
        E. *Middle lobe of terminal lft. trifid* .... 7. **decora**
        8. **peregrina**
        9. **paradoxa**
        EE. *Middle lobe of terminal lft. rarely bifid, never trifid*..10. **arietina**

1. **Moután**, Sims (*P. arbòrea*, Donn). TREE PEONY. Stem 3–6 ft. or even higher if not cut back, much branched: lvs. glabrous; lfts. more often entire at the base of the plant than above: fls. as in *P. officinalis*, but various in color: follicles numerous, very hairy, rather small. May, June. China. Long cult. there, where varieties are numbered by the hundreds. Var. **rubra-plèna**, Hort. Rose-colored, almost single. L.B.C. 11:1035. Var. **rosea-supérba**, Hort. Fls. much more doubled. Gn. 31:580 (as Reine Elizabeth). F.S. 14:1395–6 (Triomphe de Grand). Var. **vittàta**, Hort. Fls. single, white, rose and flesh color, striped, fragrant. F.S. 7:747. Var. **papaveràcea**, Andr. Petals thin and poppy-like, white, with red at center of flower. L.B.C. 6:547. Gn. 38:775; 52:1141, and pp. 324, 325. Var. **Bánksii**, Andr. Fls. much doubled, rose-colored, and large. B.M. 1154.

2. **Brównii**, Dougl. (*P. Califórnica*, Torr. & Gray). Low: lvs. glaucous or pale, lobes obovate to nearly linear: fls. dull brownish red; petals 5 or 6, thickish, little longer than the concave sepals; outer sepals often leaf-like and compound; flower-stem reclining or recurved; disk many-lobed: follicles 4–5, nearly straight, glabrous; seeds oblong. Early spring or summer. Pacific states. B.R. 25:30.

3. **albiflòra**, Pallas (*P. édulis*, Salisb.). Figs. 1616, 1617. Stem 2–3 ft., often branching and bearing from 2–5 fls.: lfts. 3–4 in. long, oblong, deeper green than *P. Brownii*, veining red: peduncle longer than in *P. officinalis*, often with a large simple bract: outer sepals large, leaf-like: petals large, various in color, usually white or pink: follicles often 3–4, ovoid, with spiral stigmas. June. Siberia. B.M. 1756. F.S. 8:812. Gn. 30:576 (var. *Adrian*); 50, p. 170; 51:1123.

Var. **Reevesiàna**, Loud. (*P. Reèvesii*, Hort.). A double form, with deep red petals. P.M. 1:197.

Var. **Sinénsis**, Steud. (*P. Chinénsis*, Vilm.). A tall Chinese variety, with large, double, crimson flowers. One of the commonest forms in gardens. B.M. 1768.

Var. **festiva**, Planchon. Fls. double, white, with a few marks of carmine in the center. F.S. 8:790.

4. **tenuifòlia**, Linn. Fig. 1618. Stem 1–1½ ft. high, 1-headed, densely leafy up to the flower: lvs. cut into numerous segments, often less than 1 line broad: fl. erect; petals dark crimson, elliptic-cuneate, 1–1½ in. long; anthers shorter than the filaments; stigma red, spirally recurved: follicles 2–3, about ½ in. long. June. Caucasus region. B.M. 926. A.G. 17, p. 658.—Var. **flore-plèno**, Hort. Fls. dense, double, crimson. F.S. 4:308. Var. **hýbrida**, Hort. Fls. rich crimson: lvs. very pretty.

5. **anómala**, Linn. As tall as *P. officinalis*, glabrous: lvs. cut into numerous, confluent, lanceolate, acute segments: fl. solitary, single, bright crimson, very large; outer sepals often produced into compound leafy points; petals obovate to oblong: follicles 3–5, ovoid, arcuate, tomentose or glabrous. Eu. and Asia. B.M. 1754.

Var. **insignis**, Lynch. This is the variety of the above which is most cult. Stems 1½–2 ft. high: lvs. about 10, the lower ones very large, gradually reducing to the fl.: carpels with red pubescence. The name **Peter Barr** is given to a form of this in which the lvs. do not so gradually reduce to the flower.

Var. **intermèdia**, C. A. Meyer. Lvs. deeply lobed: fls. rosy crimson.

6. **officinàlis**, Linn. (*P. fúlgida*, Sabine). Fig. 1619. Stem stout, 2–3 ft. high, 1-headed: lvs. dark above, pale beneath, the lowest more divided than the others, having 15–20 oblong-lanceolate lfts., 1 in. or more broad; outer sepals leaf-like: petals dark crimson, 1½–2 in. broad, obovate: stigmas crimson, recurved: follicles 2–3, becoming 1 in. long. May, June. Europe. One of the commonest in gardens. B.M. 1784; 2264 (as *P. pubens*). Gn. 53, p. 233.

1617. Pæonia albiflora.

Var. **alba-plèna**, Hort. Fls. double, white, tinged with red. Gn. 19:265. Garden forms are given trade names, as: **rosea maxima, rosea pallida, rubra,** and many others. These vary in color from nearly pure white to pink and beautiful shades of red.

Some horticultural forms, with nearly single flowers of recent importation and not yet much used, are: **anemonæflòra,** crimson, globular fls., with a mass of twisted crimson stamens, edged with yellow. A.G. 17:663. Gn. 31:599; *blanda*, pale pink; *lobata*, lvs. distintly lobed: fls. cerise-salmon, a very unusual color; *Otto Froebel*, deep salmon-red; *ròsea*, rich deep rose; *Sabìni*, rich deep crimson petals and yellow stamens. L.B.C. 11:1075; *Sunbeam*, rich cerise-salmon. Some of the largest flowered Peonies, with double flowers, are: *atrorubens plena*, deep blood-red; *Double Anemone-flowered Red; Double Anemone-flowered Rose; Old Double Red; Old Double Rose; Old Double Flesh-White.*

1618. Pæonia tenuifolia (× ⅓).

Var. **festiva,** Tausch. Fls. white, with red centers. Native of Europe.

7. **dècora,** Anders. Stems 2–3 ft. high: lvs. horizontal, diminishing to the top; lfts. oblong-obtuse: fls. rather small: petals few, small, narrow: peduncle long: follicles hairy, large, spreading from the base when mature. S. Eu. Two garden forms are: *Gertrude Jekyll*, rich crimson; *Monte Gear*, pink.

Var. **Pàllasii,** Anders. Lvs. narrow-oblong: fls. rich crimson.

Var. **elàtior,** Anders. Lvs. broadly oblong: fls. rich crimson, very large: receptacle with few processes, and a connection between the carpels at their base of similar surface and appearance to that of the carpels.

8. **peregrìna,** Mill. Stems about 1½–2 ft. high: lvs. 5–6 on a stem, deep green and glabrous above, pale green and pilose beneath; otherwise the lvs. and fls. are much like those of *P. officinalis*. Europe. Two beautiful garden forms with double fls. are: *amaranthéscens sphérica* and *pulchérrima plèna*, the latter differing from the former in the purple shade of crimson fls. The 7 following have recently been imported from England. They have fls. with usually a single whorl of petals: *Blushing Maid*, blush pink; *Brilliant*, bright purple-crimson; *Byzantina*, crimson; *compácta*, plant dwarf and bushy: fls. crimson: *Exquisite*, soft satiny pink; *Ruby Queen*, bright ruby red; *Seraph*, bright pink.

9. **paradóxa,** Anders. Plant one of the dwarfest: lvs. in a dense tuft; lfts. 3-lobed and incised: fls. purple-red: carpels pressed closely together. Trieste.—Differs from *P. peregrina* by smaller ovate and more glaucous leaves, leaflets more divided and crowded. Var. **fimbriàta,** Hort. Double purple fls., with projecting purple stamens; very pretty, but not much cult. in America.

10. **arietìna,** Anders. Stem 2–3 ft. high, hairy toward the top: lvs. 5–6 on a stem, rather glaucous and pubescent beneath; segments oblong to oblong-lanceolate, strongly confluent, decurrent: fls. always solitary, dark red, large: follicles 3–4, densely tomentose, ovoid, spreading widely, becoming 1 in. long, strongly arched; stigma recurved. Southern Europe. B.R. 10:819 (as *P. Cretica*).—There are a number of horticultural varieties. Eleven of these are: *Andersonii*, bright rose; *Bàxteri*, crimson; *Crética*, blush-pink; *Crown Prince*, deep rich crimson; *Diogenes*, bright crimson; *Excelsior*, brilliant rose; *Matador*, pure rose; *Northern Glory*, large, soft rose-pink; *Penelope*, bright rose; *Purple Emperor*, crimson-purple; *Rosy Gem*, rose-pink.

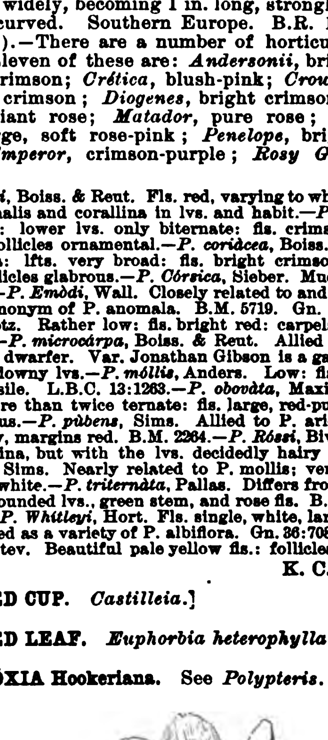
P. Bròteri, Boiss. & Reut. Fls. red, varying to white. Allied to P. officinalis and corallina in lvs. and habit.—*P. corallìna*, Retz. Tall: lower lvs. only biternate: fls. crimson; petals rounded: follicles ornamental.—*P. coriàcea*, Boiss. Allied to P. albiflora: lfts. very broad: fls. bright crimson; stigma purple: follicles glabrous.—*P. Córsica*, Sieber. Much like the preceding.—*P. Emòdi*, Wall. Closely related to and sometimes called a synonym of P. anomala. B.M. 5719. Gn. 45:946.—*P. hùmilis*, Retz. Rather low: fls. bright red: carpels glabrous. B.M. 1422.—*P. microcárpa*, Boiss. & Reut. Allied to the preceding, but dwarfer. Var. Jonathan Gibson is a garden form, with very downy lvs.—*P. móllis*, Anders. Low: fls. deep red and subsessile. L.B.C. 13:1263.—*P. obovàta*, Maxim. Lower lvs. not more than twice ternate: fls. large, red-purple: follicles glabrous.—*P. pùbens*, Sims. Allied to P. arietina: lvs. hairy below, margins red. B.M. 2264.—*P. Róssi*, Bivon. Allied to P. corallina, but with the lvs. decidedly hairy below.—*P. sessiliflòra*, Sims. Nearly related to P. mollis; very low: fls. subsessile, white.—*P. triternàta*, Pallas. Differs from P. corallina in its rounded lvs., green stem, and rose fls. B.M. 1441 (P. Daurica).—*P. Whìtleyi*, Hort. Fls. single, white, large; should be considered as a variety of P. albiflora. Gn. 36:708.—*P. Wittmaniàna*, Stev. Beautiful pale yellow fls.: follicles glabrous. B.M. 6645.

K. C. DAVIS.

PAINTED CUP. *Castilleia.*]

PAINTED LEAF. *Euphorbia heterophylla.*

PALAFÓXIA Hookeriana. See *Polypteris*.



1619. Pæonia officinalis (× ⅓).

PALAÙA (after A. Palau y Verdera, professor of botany at Madrid the latter half of the eighteenth century). Also written *Palava*. *Malvàceæ*. *P. flexuosa* is a half-hardy annual, with prettily cut foliage and 5-petaled pale rose fls. about 1¼ in. across, borne in summer and fall. Palaua is a genus of 5 species, 4 from Peru and 1 from Burma. They are annual or perennial herbs, tomentose or somewhat glabrous: lvs. usually lobed, dissected or sinuate: bractlets 0: fls. axillary, peduncled.

solitary; calyx 5-cut: ovary many-celled; style stigmatose at the apex; carpels crowded without order.

flexuòsa, Mast. Slender, branched from roots: stems 8–10 in. long, ascending, flexuous above: leaf-stalks 1–2 in. long; blades 1–2 in. long and broad, triangular in outline, pinnatifid, the segments lobed; lobes obtuse: fls. mauve, paler towards center, with bright red anthers which are very numerous and arranged in 5 longitudinal series; styles 25–30. Peru. B.M. 5768.

PALÀVA. See *Palaua.*

PALIÙRUS (ancient Greek name). *Rhamnàceæ.* Spiny trees or shrubs with alternate, 2-ranked, 3-nerved lvs., small greenish yellow fls. in axillary clusters and orbicular broadly winged, curiously shaped fruits resembling a head with a broad-brimmed hat. The one species cultivated in this country is not reliably hardy north of Washington, D. C.; in Mass. it is killed every winter almost to the ground even with protection, and the young shoots flower but bear no fruit. It is not very ornamental, but the dark green foliage is pretty and the curious fruits are interesting. It thrives in any well-drained soil and prefers a sunny and warm position. Prop. by seeds stratified or sown in autumn and by layers or root-cuttings. Four species from S. Europe to China and Japan. Stipules usually changed into spines: fls. small, perfect, in axillary or sometimes terminal cymes; petals 5, 2-lobed; stamens 5: fr. woody, 3-celled, depressed subglobose, with a broad, orbicular, horizontal wing; cells 1-seeded.

Spina-Christi, Mill. (*P. austràlis*, Gærtn. *P. aculeàtus*, Desf. *Zizyphus Paliùrus*, Willd. *Rhámnus Paliùrus*, Linn.). JERUSALEM THORN. CHRIST'S THORN. Spreading, spiny shrub to 10 ft., sometimes procumbent: 1 of the 2 spines at the base of the petioles straight, the other hooked and recurved: lvs. rather slender-petioled, ovate, usually unequal at the rounded base, obtuse, minutely serrulate, glabrous, dark green above, pale or grayish beneath, ¾–1⅛ in. long: fls. in axillary short-peduncled cymes: fr. brownish yellow, about ¾ in. across, glabrous. June, July. S. Eur. to Himal. and N. China. B.M. 1893 (as *Zizyphus Paliurus*) and 2535 (as *P. virgatus*).—This plant is supposed to have furnished the crown of thorns which was placed on the head of Christ before his crucifixion; others believe *Zizyphus Spina-Christi* to be the shrub the crown was made of. These two shrubs resemble each other so closely that they hardly can be distinguished without frs. which are berry-like in Zizyphus; the shape of the thorns is exactly the same in each species.

P. orientàlis, Hemsl. Tree, to 30 ft.: lvs. 2–4 in. long, glabrous: fr. 1–1½ in. across, glabrous, purplish. China. This but recently introduced species is perhaps the most ornamental of the genus; it has not proved hardy at the Arnold Arboretum.—*P. ramosíssimus*, Poir. (P. Aubletia, Rœm. & Schult.). Shrub similar to P. Spina-Christi, but with both spines straight, larger lvs. pubescent beneath, and smaller tomentose frs. China, Japan.

ALFRED REHDER.

PALM. Plate XXIV. Palms are amongst the most striking plants in tropical floras. Their tall, straight, unbranched trunks surmounted by a spreading canopy of huge pinnate or digitate foliage distinguish them from nearly all other forms of vegetation. They are widely spread in tropical regions, being most abundant in America and few in Africa. They are particularly conspicuous in the Pacific islands. Although the Palms are such bold and interesting plants, the species are very imperfectly understood. This is due to the great difficulty of making herbarium specimens, to the fact that the greater number of botanists are residents of regions in which Palms do not grow, and to the differences of opinion as to the relative importance of the various botanical characters. Many of the Palms have been named first from cultivated specimens, and often before the flowers and fruits are known. When the specimens finally come to fruit, the names are usually shifted, causing much confusion. The proper generic position of a Palm may be unknown for several years after it becomes popular in the horticultural trade. Consider the changes in nomenclature which have occurred in Palms that have been referred to the genera Areca and Kentia.

The species of Palms are not very numerous. They probably do not exceed 1,000, although more than that number have been described. Bentham & Hooker accept 132 genera, and Drude, in Engler & Prantl's "Pflanzenfamilien," accept 128 genera. Most of the genera are small, and many of them are monotypic. The largest genera are Calamus, with about 200 species, all Old World, mostly Asian; Geonoma, with about 100 species, all American; Bactris, about 100, American; Chamædorea, with about 60, all American; Licuala, with 30, ranging from eastern Asia to Australia; Desmoncus, about 25, American; Cocos, 30, all confined to America but the cocoanut, which is now cosmopolitan; Pinanga, with about 25 species, of the Oriental tropics; Areca, nearly two dozen, Oriental. Many of the species, particularly in the small genera, are restricted to very small geographical regions, often to one island or to a group of islands. The Palms represent an old type of vegetation, and they are now, no doubt, on the decline.

Palms have been favorite greenhouse subjects from the period of the first development of the glass planthouse. The stereotyped form of conservatory is a broad or nearly square structure, with narrow benches around the sides over the heating pipes and a Palm bed in the center. In these conservatories a variety of Palms will succeed, requiring neither a very high temperature nor much direct sunlight. In fact, Palms usually succeed best under shaded roofs. The Palms are most satisfactory in their young state, before the trunks become very prominent, and before the crowns reach the glass. The larger number of Palms have pinnate or pinnatisect leaves, and these species are usually the more graceful in habit. Small Palms are now in great demand for room and table decoration, and a few species are grown in enormous quantities for this trade. They are sold when small. They usually perish before they are large enough to be cumbersome. Amongst the most popular of these Palms are *Chrysalidocarpus lutescens*, *Howea Belmoreana* and *Forsteriana*, *Cocos Weddelliana*, *Livistona Chinensis*, and possibly one or two species of Phœnix.

Some Palms endure considerable frost without injury. Of such are the Sabals and the Palmettoes of the southern states. The Saw Palmetto (*Serenoa serrulata*) and the Blue Palmetto (*Rhapidophyllum Hystrix*) occur as far north as South Carolina. In Asia, Nannorhops grows naturally as far north as 34°, and in Europe, Chamærops (the only Palm indigenous to Europe) reaches 44°.

In the tropics, Palms furnish houses, clothing, food and ornaments. The range of the economic uses is well indicated by the following extract from Drude (in Engler & Prantl): "In a family which, like the Palms, is of such extraordinary importance in satisfying so many human wants, it seems well to make a few general remarks on this subject as an introduction to special remarks under the different genera. A European does well to distinguish between the products of the Palms which are imported from the tropics, and those which are used by the civilized peoples and more especially by the natives in the tropics. Of the first, there should be noted a few fruits, as, for example, dates and cocoanuts, whose use gives us a slight picture of the importance of Palm fruit of the tropics. Then follows the Indian sago coming from the pith of the stems, which surpasses in quality the European product, and then the oil made from fruits of oil Palms which, considering its almost unlimited supply, is of more importance than the olive oil. In Europe a great rôle is played by the fibers coming from many Palms, as the Piaçaba and Cocoa fibers. Perhaps, in the course of time, one or other of the Palm-leaf products will find greater use in the production of paper. The numerous kinds of 'Spanishschen Rohres,' that is, those thin stems of the genus Calamus which have a silicious covering, are necessary in the making of bent-wood furniture and baskets. Wax (from Copernicia, probably not from Ceroxylon) plays in Europe, as a competitor of beeswax, but a small rôle. On the other hand, the stone nuts, seeds of Phytelephas and the stony kernels of some Cocoineae, are imported from America in ton quantities, to be used in making small articles. To these products, of considerable influence on the European trade, must be added numberless others used in the tropics, where the numerous sweet as well as the starch-holding fruits are at the command of the inhabitants. From many species are cut out the soft terminal bud (heart), which is eaten as Palm salad, and from other very large species the young stems are cut off and the great quantity of sweet sap is worked to sugar, or arrac, or is used as Palm wine. Many stems furnish excellent building wood, and in the artistic industries of the Malays and Papuas as well as that of the natives of Brazil, such Palms furnish not only the main timbers of their huts, but the leaves are plaited and used for the sides and the roof. Other leaves cut in small strips give them coverings, mats, fans, shields, complete clothing and hats. Even the spines are used as tips for spears, for tattooing-paints and for hooks; whereas the fish-line itself is made of the strong fibers of other species. Other uses, as that of the betel nut (Areca), in chewing, are worthy of mention also."

As the trunk of the Palm rises, the leaves underneath the crown die and fall. Usually the old petioles, or their bases, remain for some time, forming a shaggy capital to the column; this is well marked in the large or Cabbage Palmetto of the South. The Palms are mostly trees, and some of them rise to the height of nearly 200 ft., but some are climbing and others are low shrubs. In some species the stems are prickly. Usually they make very straight, comely boles, but a few species produce branches above. The flowers of Palms usually arise underneath or in the crown, from the axils of the leaves. The clusters are really spadices, although often branched, and are covered in the bud by a dry spathe composed of one or several leaves or parts. The remains of these spathes are well shown in Fig. 1497, p. 1100. In the upper cluster on the left the spathe is arching over the fruits. The blossoms are relatively small, and usually dull colored and not showy. The flowers are perfect or unisexual, 3-merous,—the segments usually 6 in two series, stamens usually 3 or 6, ovary usually 3-loculed or the 3 carpels wholly separate, stigmas 3 and usually sessile. The fruit is various, being either a drupe or hard berry-like structure, often edible.

The genera chiefly known to horticulturists are the following:

Tribe Areceæ. *Lvs. pinnatisect, the leaflets free or joined so as to form a plaited limb, the sides in vernation reduplicate: fls. monœcious or diœcious: seeds umbilicate, with ventral raphe and dorsal embryo.*

Areca, Pinanga, Kentia, Hydriastele, Kentiopsis, Hedyscepe, Nenga, Archonthophœnix, Rhopalostylis, Dictyosperma, Ptychosperma, Cyrtostachys, Drymophlœus, Cyphophœnix, Clinostigma, Cyphosperma, Euterpe, Acanthophœnix, Oreodoxa, Bacularia, Linospadix, Howea, Ceroxylon, Verschaffeltia, Dypsis, Chamædorea, Hyophorbe, Roscheria, Geonoma, Calyptrogyne, Wallichia, Didymosperma, Arenga, Caryota, Phytelephas.

Tribe Phœniceæ. *Lvs. pinnatisect, segments acuminate and with induplicate sides in vernation: spadices interfoliar, the spathe solitary: fls. diœcious: carpels 3, only one maturing, the stigma terminal: seed strongly ventrally sulcate, the embryo dorsal.*

Phœnix.

1620. A Palm house.

Tribe Corypheæ. *Lvs. fan-shaped, wedge-shaped or orbicular, plaited, more or less cut, the lobes with induplicate sides: spadices interfoliar, the spathes many: fls. usually perfect: ovary entire or 3-lobed, or sometimes the 1–3 carpels distinct, the ovule erect: pericarp usually smooth: seeds with ventral raphe and small hilum.*

Corypha, Sabal, Washingtonia, Chamærops, Rhapidophyllum, Acanthorhiza, Brahea, Erythea, Pritchardia, Licuala, Livistona, Trachycarpus, Rhapis, Thrinax.

Tribe Lepidocaryeæ. *Lvs. pinnatisect or fan-shaped, the segments with reduplicate sides in vernation: spadices terminal or axillary. the spathes numerous: fls. polygamo-monœcious: ovary entire, more or less 3-loculed: fr. clothed with reflexed, shining, imbricate, appressed scales: seed with dorsal raphe and ventral embryo.*

Calamus, Ceratolobus, Raphia.

Tribe Borasseæ. *Lvs. orbicular, the segments fan-shaped and the sides induplicate: spadices interfoliar, the spathes many and sheathing: fls. diœcious, the male minute and sunk in cavities on the spadix, the female very large: ovary entire, 3-loculed, the ovule ascending: fr. various.*

Borassus, Lodoicea, Latania, Hyphæne.

Tribe Cocoineæ. *Lvs. pinnatisect, the leaflets with reduplicate sides: spadices interfoliar, unisexual or androgynous, the spathes 2 or more: inferior fls. often in 3's, the middle one female: ovary 1–7-loculed: fr. large, drupe-like, 1–7-loculed, the stigma terminal, the endocarp or shell hard and woody and provided with 3–7 pores.*

Bactris, Astrocaryum, Acrocomia, Martinezia, Elæis, Diplothemium, Cocos, Maximiliana, Scheelea, Attalea, Jubæa.

There is very little accessible monographic literature on the Palms. Martius' "Historia Naturalis Palmarum."

Munich, 3 vols., 1823–1850, is a standard work. Kerchove de Denterghem's "Les Palmiers," Paris, 1878, is an important work. A popular running account of Palms and the various kinds, by William Watson, will be found in the following places in Gardeners' Chronicle: 1884 (vol. 22), pp. 426, 522, 595, 728, 748; 1885 (vol. 23), pp. 338, 410, 439; 1885 (vol. 24), pp. 362, 394, 586, 748; 1886 (vol. 25), pp. 75, 557; 1886 (vol. 26), pp. 491, 652; 1887 (vol. 2, ser. 3), pp. 156, 304; 1891 (vol. 9), pp. 234, 298, 671; 1893 (vol. 13), pp. 260, 332.
L. H. B.

Hardy Palms in California.—Palms grown in the open in California gardens do not exceed in number 20 genera, and numbering about 60 species. The following 17 genera of about 40 species may be found in our best Palm collections, and all these species are growing in the gardens of Los Angeles and vicinity, and may be found throughout southern California in limited numbers from San Diego to Santa Barbara. Occasional plants of species not mentioned are found in some old gardens, but are not so plentiful as to be considered in a general list of our hardy Palms. In enumerating these plants they are placed as to their importance, or rather as to their numerical strength in California. Our native Fan-Palms, the Washingtonias, natives of San Bernardino and San Diego counties, have been most extensively planted, and may be found everywhere, serving, in some instances, a variety of purposes. Fig. 1622. In growing this Palm water is of the first importance. When planted along a street, those adjoining vacant lots often remain nearly at a standstill, except in case of an unusually wet winter, while those along the cultivated lots or lawns grow faster than any other Palm. When one in its native habitat blows over by the force of the desert winds, the hole left by the roots and stump invariably fills with water. Washingtonias are hardy 600 miles north of Los Angeles. It may be well to state that hardiness in Palms is principally a question of size, the larger ones passing through the most severe winter unharmed, while the small ones may perish. So, too, some Palms supposed to be very tender need protection from sun more than from frost. This is particularly the case with the so-called Kentias and Rhapis. A certain Howea (or *Kentia Forsteriana*) is protected only by a large overhanging branch of a sycamore, which is of course leafless in cold weather, yet it has reached a height of 12 feet, with a diameter at base of 12 inches, and it has never been injured by frost, yet water hydrants 10 feet away have been frozen so hard as to burst them. In Los Angeles is a Kentia 15 feet high, growing on the north side of a house, protected from sun alone, being 20 feet from the building, where for several winters the ground near by has frozen to the depth of 1 inch. This is in the bottomlands, the coldest part of the city.

1621. Date Palms at Old Town, San Diego.

1622. A Sentinel Palm.
Washingtonia filifera, San Jacinto Mts., Cal.

Phœnix dactylifera, though not so ornamental as others of the genus, was extensively planted in early days and is one of the hardiest of Palms. Fig. 1621. The most popular Palm for the masses, who look for grace and beauty combined with cheapness, is *Phœnix Canariensis*. More of these are planted at present than any other three species. In Los Angeles and vicinity they may be counted by tens of thousands. Like these two for hardiness is *P. reclinata;* and all may be seen growing north of San Francisco some 200 miles. All the genus is hardy in southern California. *Trachycarpus excelsus* and *Chæmerops humilis*, the latter varying greatly in appearance, will grow as far north as any Palms and are popular everywhere. The former in thirty years will grow to the height of 25 feet, while the latter will make 8–10 feet of trunk in the same time. *Livistona australis* and *L. Chinensis* are both popular, though not hardy outside the southern part of the state, and the latter must be shaded from noonday sun. *Erythea armata* and *E. edulis* (often known as Braheas) grow around San Francisco bay luxuriantly. *Cocos eriospatha* is hardy even farther north than the Erytheas, and is by far the most ornamental Palm to be found in that section. Other Cocos in southern California are *C. flexuosa*, *plumosa*, *coronata*, *Romanzoffiana*, and many others. Any Cocos will grow here in protected places except Weddelliana. *C. plumosa* is without doubt the most graceful Palm grown, and at present very extensively planted in the southern citrous belt, sometimes for street or sidewalk trees. It is also one of the fastest growers, and will reach 20 feet in fifteen years, with ordinary care. *Archontophœnix Alexandreæ* and *A. Cunninghamii*, the most elegant of our Palms after *Cocos plumosa*, are not quite so hardy but will thrive from Santa Barbara southward, in warm locations. The same exposures, with shade during the hottest part of the day, will do for *Hedyscepe Canterburyana* and *Howea Forsteriana* and *H. Belmoreana;* also *Rhopalostylis Baueri* and *R. sapida*. The four species of Sabals seem to thrive and seed well in this section, though *S. Palmetto* and *S. Blackburnianum* grow much faster than the others. *Rhapidophyllum Hystrix* is perfectly hardy, but on account of its dwarf habit is not so extensively planted as its merits deserve. *Rhapis flabelliformis* and *R. humilis* need protection from sun alone, though there is a Rhapis growing for ten years without protection from either sun or frost, and in the coldest section of Los Angeles, but its color is not all that could be desired. Chamædoreas are planted only where they can be protected from both frost and sun, though they thrive better under such circumstances than they do under glass. In such situations they are just the plant for the purpose, as they do not grow away from the protecting tree as do sun- and light-loving Palms, but remain erect. *Brahea dulcis* may occasionally be seen but grows too slowly to be popular. One of our grandest and hardiest Palms, one that deserves for many reasons to be more extensively planted, is *Jubæa spectabilis*. We have a few 20 feet in height with a bole 4 feet in diameter, and are much more striking in appearance than any of the Phœnix, which latter they somewhat resemble.

ERNEST BRAUNTON.

The word Palm is a popular designation of one of the largest and most important families among the monocotyledons, about 1,200 species of Palms having been recorded, though many of these are not yet in cultivation. The members of this family are essentially tropical in habitat, are highly ornamental in appearance, and many of them also of very great economical value, their fruits, stems and leaves not only entering largely into the manufactured products of both Europe and America, but also providing both food and shelter for thousands of the inhabitants of tropical countries. One notable characteristic of Palms in general is their unbranched stems, the exceptions to this rule being very few, and mostly limited to the members of one genus, Hyphæne, of which the Doum Palm of Egypt, *H. Thebaica*, is the best example. While these unbranched stems form a prominent feature in connection with this order of plants, yet great variations are found in size and habit; some of them towering up like a slender marble shaft to a height of more than 100 feet and then terminating in a crown of magnificent plume-like leaves, while others may reach a height of only 3-4 feet when fully developed. In some instances the stems are so long and slender that a scandent habit is the result; these rope-like stems of the Rattan Palms in particular are described as wandering through the tops of some of the great trees of the Malayan Peninsula to a length of several hundred feet.

1623. A digitate-leaved Palm, and one of the best Palms for small conservatories—Rhapis flabelliformis.

The foliage of the Palms is of two chief kinds, the fan-veined leaves, in which the venation radiates from a common center, and the feather-veined, in which the veins run out from the sides of a long midrib, the leaf being frequently divided into long, narrow segments. Of the first group the common Fan Palm, *Livistona Sinensis*, is a good example, while the Date Palm, *Phœnix dactylifera*, and also the Cocoanut, *Cocos nucifera*, are common examples of the feather-veined class.

There are also minor characteristics of foliage that mark many of the genera, some having pinnate leaves with erose tips, a few having bipinnate leaves (as *Caryota urens*), others with flabellate leaves having erose segments, and many with the segments of the leaves bifid or split at the tips.

The flowers of Palms in general are not specially attractive either in size or coloring, many of them being greenish white or yellow, and some orange or red; but these flowers are produced in prodigious quantities by some of the species, perhaps the most prolific in this respect being the Talipot Palm (*Corypha umbraculifera*), which throws up a branching inflorescence to a height of 30 ft. above the foliage, such an inflorescence having been estimated to include fully sixty millions of flowers!

The seeds of Palms are also found in many sizes and various shapes, ranging from the size of a pea in some of the Thrinax to the unwieldy fruits of the Double Cocoanut, *Lodoicea Sechellarum*, which will sometimes weigh 40 lbs. each and require several years to reach maturity.

As a rule, the members of any single genus of Palms are found in one hemisphere, either the eastern or western as the case may be, probably the greater number of species being of Asiatic origin, and comparatively few being found in Africa. An apparent exception is found to this system of hemispheric distribution in the case of the Cocoanut, this plant being so very widely distributed throughout the tropical world that its original habitat is still in doubt. On the other hand, some species are found to be very local in their natural state, in proof of which the Howeas may be cited; this genus has been found only within the circumscribed area of Lord Howe's Island, which from a comparative point of view may be termed merely a fragment of land (probably of volcanic origin), a mere dot on the broad bosom of the South Pacific.

Few Palms are found within the limits of the United States as natives, the most common being the well-known Palmetto, *Sabal Palmetto*, a member of the fan-leaved section, to which possibly all of our native Palms belong. But while the species of Palms found native in the United States are limited in numbers, yet there is at least one unique species in the group in the form of *Pseudophœnix Sargenti*, a monotypic Palm, that is only known to exist in a wild state on certain of the Florida Keys, and in quite limited numbers even there.

1624. Germination of Chrysalidocarpus lutescens.

Europe is even less favored as to native Palms, there being but one species known there in that condition, *Chamærops humilis*, also a fan-leaved species and comparatively hardy, being capable of enduring moderate frosts.

The Palm tree of the Bible is doubtless the Date Palm, *Phœnix dactylifera*, which is found in large numbers throughout Syria to this day; and in fact the small grove of dates within easy reach of the Syrian householder forms one of his most valuable assets, for it provides food not only for his family, but frequently for his horses or camels also.

The act of producing flowers does not necessarily terminate the life of a Palm, though in some instances such an effect may be produced by this cause; but a singular habit has been noted in regard to the flowering of the Fish-tail Palm, *Caryota urens*, which when it reaches maturity begins to throw out a flower-spike from the top of the stem, this being followed by successive spikes of flowers, and ultimate bunches of seeds from the top of the plant downwards, the flower-spikes appearing at the joints of the stem, and when this process of flowering has proceeded down to the ground, or until the vitality of the plant has been exhausted, death ensues.

There are also a number of species of Palms that develop a soboliferous habit, throwing up a number of shoots from the base of the plant, *Rhapis flabelliformis*, sometimes known as the Ground Rattan, being a good example of this class, among which the widely grown and elegant *Chrysalidocarpus lutescens* is also found, together with the Geonomas, some of the Phœnix and various other genera. Many of the Palms are unisexual, but there are also many others in which both male and female flowers are produced on the same spadix, in some instances the males being grouped together near the ends of the branches of the inflorescence and the females nearer to the main stem, while in others a female is placed between two males, thus arranging the flowers in threes.

Cross-pollination of Palms by artificial means has probably been seldom practiced, there being few cultivated collections in which the opportunity for such an operation has presented itself; but it seems highly probable that such cross-fertilization has been accidentally effected among wild plants, for in large lots of seedlings intermediate forms are frequently seen, this peculiarity having been noted among Howea seedlings, where forms intermediate between *H. Belmoreana* and *H. Forsteriana* are found, and sometimes seedlings that seem to combine the characteristics of *H. Belmoreana* and those of its near relative *Hedyscepe Canterburyana*. Similar variations from a given type have also been noted among the Phœnix, several so-called species being most likely merely varieties.

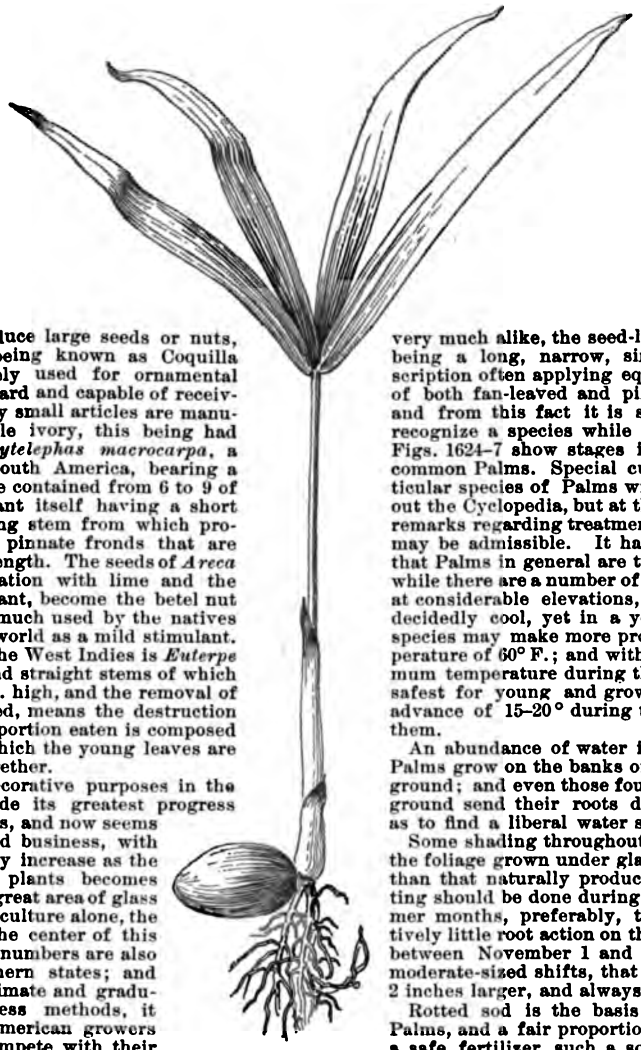
Many Palms are armed with stout thorns or prickles, not only the stems but also the leaves and even the fruits in some species being thus guarded, these prickles being usually very hard and tough. In some cases, notably *Acanthorhiza stauracantha*, the prickles around the stem are often branched, and are decidedly unpleasant to come in contact with. In the case of Desmoncus, this being the western representative of the Rattan Palms, the tip of the midrib of the leaf is continued in the form of a hooked spine, and helps to support the plant in its scandent career. The sharp spines of certain Palms are used for poisoned arrows by some of the South American tribes, these arrows being projected through a blow-pipe formed from a section of the hollow stem of another Palm. Among the species of Phœnix it is often found that several of the leaflets nearest to the base of the leaf are developed as spines, these thorny leaflets becoming stiff and hard, and capable of making a very sore wound.

The very great economical value of many of the Palms can only be touched upon within the limits of the present article, the uses to which not only the fruits but also the stems and leaves are put by the natives of many tropical countries being enough of themselves to fill volumes. One prominent instance of this great utility is the Palmyra Palm, of which a Hindoo poet enumerated over 800 different uses. Other notable examples include the Cocoanut Palm, the fruits of which are imported by hundreds of tons every year, and in addition to providing a valuable food, either fresh or in a desiccated condition, also produce that very valuable fiber from which cordage, matting and a great variety of goods are manufactured. Also the Phœnix family, which produces the dates of commerce in apparently endless supply, and the date sugar of Bengal, this being contributed by *Phœnix sylvestris*, while the stems of Date Palms are often used in house-building in the East. Another very valuable Palm product is found in Palm oil, this being largely derived from the fruits of *Elæis Guineensis*, the oil being expressed from the ripe fruits in much the same manner that olive oil is manufactured. The rattan of commerce is chiefly composed of the flexible stems of various calami, the plentiful supply of this material being sufficiently attested by the great variety of articles manufactured therefrom. Various Palms have been

1625. Livistona Chinensis.

1626. Germination of Cocos Weddelliana.

mentioned under the name of "Wine Palm," but it seems likely that some species of Raphia are most used for liquors, some portions of these Palms giving a large amount of sap when tapped, and as the juice is rich in sugar, the sap soon ferments and may become strongly alcoholic. The best sago is produced from the pith of Metroxylon or Sagus, the trees being cut down and split into segments for the removal of the pith, the latter being then prepared in a rough granulated form for export. Sago is also procured from Caryota and some other species, but the product is not equal to that of Metroxylon. The so-called whale-bone brooms frequently used in stables and for street-cleaning are mostly made from Piassaba (or Piaçaba) fiber, this being gathered from around the base of plants of Attaleas, mostly *A. funifera.* The Attaleas also produce large seeds or nuts, those of *A. funifera* being known as Coquilla nuts, and quite largely used for ornamental purposes, being very hard and capable of receiving a fine polish. Many small articles are manufactured from vegetable ivory, this being had from the nuts of *Phytelephas macrocarpa*, a singular Palm from South America, bearing a large fruit in which are contained from 6 to 9 of the ivory nuts, the plant itself having a short and sometimes creeping stem from which proceeds a noble head of pinnate fronds that are frequently 15–20 ft. in length. The seeds of *Areca Catechu*, after preparation with lime and the leaves of the pepper-plant, become the betel nut of the East Indies, so much used by the natives of that portion of the world as a mild stimulant. The Cabbage Palm of the West Indies is *Euterpe oleracea*, the smooth and straight stems of which are frequently 80–100 ft. high, and the removal of the "cabbage," so-called, means the destruction of such a tree, for the portion eaten is composed of the central bud in which the young leaves are compactly gathered together.



1627. Germination of Howea Belmoreana.

Palm culture, for decorative purposes in the United States, has made its greatest progress during the past 10 years, and now seems to be a well-established business, with the prospect of a steady increase as the adaptability of these plants becomes better understood. A great area of glass is now in use for Palm culture alone, the Middle States being the center of this industry, though large numbers are also grown in a few southern states; and owing to a favorable climate and gradually improving business methods, it seems probable that American growers will soon be able to compete with their more experienced brethren of Europe in this class of plants.

The species most used in commercial horticulture in the United States are contained in a very short list, the greater quantity being confined to five species, namely, *Livistona Chinensis, Howea Belmoreana, Howea Forsteriana, Chrysalidocarpus lutescens* and *Cocos Weddelliana*, while less quantities of *Caryota urens*, several species of Phœnix, *P. Canariensis* being quite largely planted outdoors in the South and on portions of the Pacific coast, *Seaforthia elegans* and some others of the Ptychosperma group, and some few Livistonas cover the extent of the catalogue for many growers.

Of these, the seeds are imported in a majority of cases, and on the quality of these seeds the success of the grower depends, so far as getting up a stock is concerned. Most of these species germinate readily in a warm greenhouse, providing the seeds are fresh, the slowest of the common commercial Palms being the Howeas. In small quantities these seeds are usually sown in about 6-inch pots, the pots being well drained and nearly filled with light soil, then the seeds sown thickly and covered with half an inch of soil, watered thoroughly and placed where they may receive the benefit of some bottom heat, and at no time should they be allowed to become very dry. The period required for germination varies greatly with different species, *Livistona Chinensis* germinating in 2 or 3 weeks if fresh, and being ready for potting in about 2 months, while seeds of some of the Attaleas have been known to remain in the earth for fully 3 years before starting.

The seedlings of many species are very much alike, the seed-leaf in many instances being a long, narrow, simple leaflet, this description often applying equally to the seedlings of both fan-leaved and pinnate-leaved species; and from this fact it is somewhat difficult to recognize a species while in the juvenile form. Figs. 1624–7 show stages in the germination of common Palms. Special cultural notes for particular species of Palms will be found throughout the Cyclopedia, but at this time a few general remarks regarding treatment of Palms as a whole may be admissible. It has already been noted that Palms in general are tropical in nature, and while there are a number of species that are found at considerable elevations, where the nights are decidedly cool, yet in a young state the same species may make more progress in a night temperature of 60° F.; and with this in view, a minimum temperature during the winter of 56–60° is safest for young and growing Palms, while an advance of 15–20° during the day will not hurt them.

An abundance of water is required, for many Palms grow on the banks of rivers or in swampy ground; and even those found on high and rocky ground send their roots down to such a depth as to find a liberal water supply.

Some shading throughout the summer is best, the foliage grown under glass being more tender than that naturally produced outdoors. Repotting should be done during the spring and summer months, preferably, there being comparatively little root action on the part of most Palms between November 1 and March 1. Give only moderate-sized shifts, that is, use pots only 1 or 2 inches larger, and always ram the soil firmly.

Rotted sod is the basis for the best soil for Palms, and a fair proportion of stable manure is a safe fertilizer, such a soil being mixed with various proportions of peat or sand, to make it lighter and more open for some delicate species.

Insects are frequently troublesome if allowed to gain headway, various scale insects doing the greatest damage, while red spiders and thrips may become established unless forcible syringing is persisted in. The most successful practice requires close observation on the part of the grower, and the prompt removal of all insects

W. H. Taplin.

PALMA Christi is Castor Oil Plant, *Ricinus.*

PALMERÉLLA (Dr. Edward Palmer, contemporaneous American botanical collector). *Lobeliàceæ.* A genus of one species, a rare herb found in Lower Calif., with small blue fls. like those of a Lobelia. The genus differs from Lobelia in the remarkable adnation of the stamens, as well as in the integrity of the corolla-tube, at least its upper part. It soon splits from the base upward for a good distance, and, indeed, before withering the lower part of the corolla is much disposed to separate into five claws (liberating also the lower part of the filaments). The filaments are adnate to the corolla-tube for a long distance and then monadelphous and adnate on one side or the other.

débilis, Gray. Slender, glabrous, branching herb: lvs. alternate, linear-lanceolate, entire, sessile, 2–3 in. long; floral ones gradually reduced to bracts: raceme lax, few-fld.: corolla-tube whitish, 9 lines long, lobes light blue, 2 of them smaller than the others, the larger ones 3–4 lines long. Var. **serràta**, Gray, was offered in 1881 by E. Gillett, but it is probably not in cult. anywhere.

PALMETTO. See *Sabal.*

PALMS, POPULAR NAMES OF. **Alexandra P.**, *Archontophœnix Alexandræ.* **Assai P.**, *Euterpe edulis.* **Betel-nut P.**, *Areca Catechu.* **Blue P.**, *Erythea armata.* **Bourbon P.**, *Latania.* **Broom P.**, *Attalea funifera* and *Thrinax argentea.* **Cabbage P.**, *Euterpe oleracea.* **Club P.**, *Cordyline.* **Cocoanut P.**, *Cocos nucifera;* Double Cocoanut or Sea Cocoanut P., Lodoicea. **Coquito P.**, *Jubæa spectabilis.* **Corojo P.**, *Acrocomia sclerocarpa.* **Curly P.**, *Howea Belmoreana.* **Date P.**, *Phœnix dactylifera.* **European P.**, *Chamærops humilis.* **Fan P.**, any species with fan-shaped, rather than pinnate lvs. **Fern P.**, *Cycas.* **Fish-tail P.**, *Caryota urens.* **Flat P.**, *Howea Forsteriana.* **Guadeloupe P.**, *Erythea edulis.* **Gru-gru P.**, *Astrocaryum vulgare* and *Acrocomia sclerocarpa.* **Hemp P.**, *Chamærops excelsa.* **Ivory-nut P.**, *Phytelephas macrocarpa.* **Norfolk Island P.**, *Rhopalostylis Baueri.* **Oil P.**, *Elæis Guineensis;* also *Cocos butyracea*, etc. **Palmetto P.**, *Sabal.* **Panama-hat P.**, *Carludovica palmata.* **Para P.**, *Euterpe edulis.* **Raffia P.**, *Raphia.* **Royal P.**, *Oreodoxa regia.* **Sago P.**, various species of *Sagus* and *Cycas.* **Savanah P.**, *Sabal mauritiæformis.* **Talipot P.**, *Corypha umbraculifera.* **Thatch P.**, *Sabal Blackburniana; Howea Forsteriana.* **Toddy P.**, *Caryota urens.* **Umbrella P.**, *Hedyscepe Canterburyana.* **Walking-stick P.**, *Bacularia monostachya.* **Wine P.** of E. Indies, *Caryota urens, Phœnix sylvestris* and *Borassus flabelliformis;* of New Granada, *Cocos butyracea.*

PALUMBÌNA (said to be from *palumbes*, wood-pigeon; from a supposed resemblance of the fls.). *Orchidàceæ.* A monotypic genus greatly resembling Oncidium, with which it was formerly united. It differs principally in having the lateral sepals entirely united, forming a single segment resembling the dorsal sepal in shape and size, the labellum scarcely larger than the petals and resembling them in shape.

cándida, Reichb. f. The only species is a small plant with narrow, compressed pseudobulbs, each with a single slender leaf, 6–12 in. long: fls. few, small, white, in a slender raceme; sepals, petals and labellum oblong, acute, differing but little in size and shape. Guatemala. B.M. 5546. G. C. 1865:793; II. 20:233 (as *Oncidium candidum*).—May be easily grown in a temperate house. Blooms in summer, the fls. lasting a long time.

HEINRICH HASSELBRING.

PAMPAS GRASS. See *Gynerium.*

PÀNAX (old Greek name, meaning *all-healing*). *Araliàceæ.* Thirty to 40 trees or shrubs, mostly of the tropics of Asia, Africa, Australia and the Pacific islands, as defined by Bentham & Hooker (including Nothopanax), some of which are grown in warmhouses for their interesting habit and foliage. The genus is confused in gardens with Aralia, Acanthopanax, Fatsia, Eleutherococcus, Polyscias, and others. From the Aralia group it is distinguished by having the petals valvate (applied edge-to-edge) in the bud. From Polyscias, Pseudopanax and Eleutherococcus it is known by its gynœcium (or pistils) being usually in 2's, rather than in 5's or higher numbers. From Fatsia it is distinguished by having the pedicel articulated beneath the flower. See *Fatsia* for another discussion of relationships. Panax has a calyx with entire or 5-toothed margin, 5 valvate petals, 5 stamens with oblong or ovate anthers, usually 2-loculed ovary which ripens into a drupe-like compressed fruit, and with mostly compound, often much-divided leaves: fls. small, sometimes polygamous, in umbels, heads, racemes or panicles. The Panaxes are to be grown in the warmhouse, where they should have the treatment given tropical Aralias (see p. 87).

As defined by others, the genus Panax includes only 7 or 8 herbaceous species, natives of the temperate regions of North America and Asia, while the woody species are referred mostly to Polyscias and Nothopanax; the species of the Polyscias have, according to Harms, pinnate leaves, and those of the other have digitate or simple leaves. As thus understood, the genus Panax includes the ginseng, *P. quinquefolium*, for which see *Ginseng.* The dwarf ginseng or ground-nut of the northern states is *P. trifolium.* It is not in the trade. These two plants are often described in the genus Aralia as *A. quinquefolia* and *A. trifolia.*

fruticòsum, Linn. (*Nothopànax fruticòsum*, Miq. *Polýscias fruticòsa*, Harms). Shrub 3–6 ft. in cult., with pinnately compound lvs., the lfts. stalked, ovate-oblong, acuminate, coarsely serrate, the ultimate ones incised, 3-lobed: fls. in paniculate umbels. Java, etc.—Prized for its fern-like foliage, but known mostly in its cultivated varieties.

Var. **Victòriæ** (*P. Victòriæ*, Hort.). Fig. 1628. A compact form which constantly sends up new stalks: foliage recurving, cut, curled and tasselled, light green, with white-variegated margins. G.C. II. 19:405. I.H. 31:521? An excellent table plant. Through inadvertence, Fig. 1628 was used in the place of *Aralia Guilfoylei* on p. 87.

1628. Panax fruticosum, var. Victoriæ.

Var. **laciniàtum** (*P. laciniàtum*, Hort.). Lvs. twice-pinnate, drooping, about as broad as long, tinted with olive-brown, the leaflets and divisions narrow. Very graceful.

Var. **excélsum** (*P. excélsum*, Hort.?). Lvs. very finely cut and fern-like, margined with white.

Var. **plumàtum** (*P. plumàtum*, Hort.). More finely cut than var. *laciniatum*, and differing from var. *excelsum* in having no white on the foliage.

lépidum, Bull. Compact: lvs. biternately divided, the end division largest; pinnules or ultimate leaflets obliquely obovate, the central one in each case small (sometimes almost rudimentary) and more or less covered by its two lateral ones, the margins spiny-toothed and cut. Brazil. Recent.

nítidum, Bull. Compact: lvs. roundish obovate, toothed and somewhat spiny, sometimes with deep incisions. Brazil. Recent.

aùreum, Sander. "A distinct elegant and highly attractive Panax, the whole leafage being suffused with a delicate golden green variegation. The habit is similar to that of *P. Victoriæ*, quite as compact and bushy, but not heavy in the slightest sense of the word. Individually the leaves are small, the edges finely serrated, while near the margins are several splashes of clear green."—*Sander.*

Bálfourii, Sander. "A decided acquisition for all decorative requirements, strikingly and profusely variegated. Its luxuriant pinnate leafage renders its deep green and creamy white coloring the more attractive. Each of the pinnæ forming the leaf is orbicular in outline and deeply serrated, of a rich ivy green, abundantly splashed with creamy white, the edges of the leaves being entirely white. The stems are bronze-green, specked with gray. The habit is compact and bushy, well feathered from base to apex with foliage. Introduced by us through our collector, Micholitz, from New Caledonia."—*Sander.*

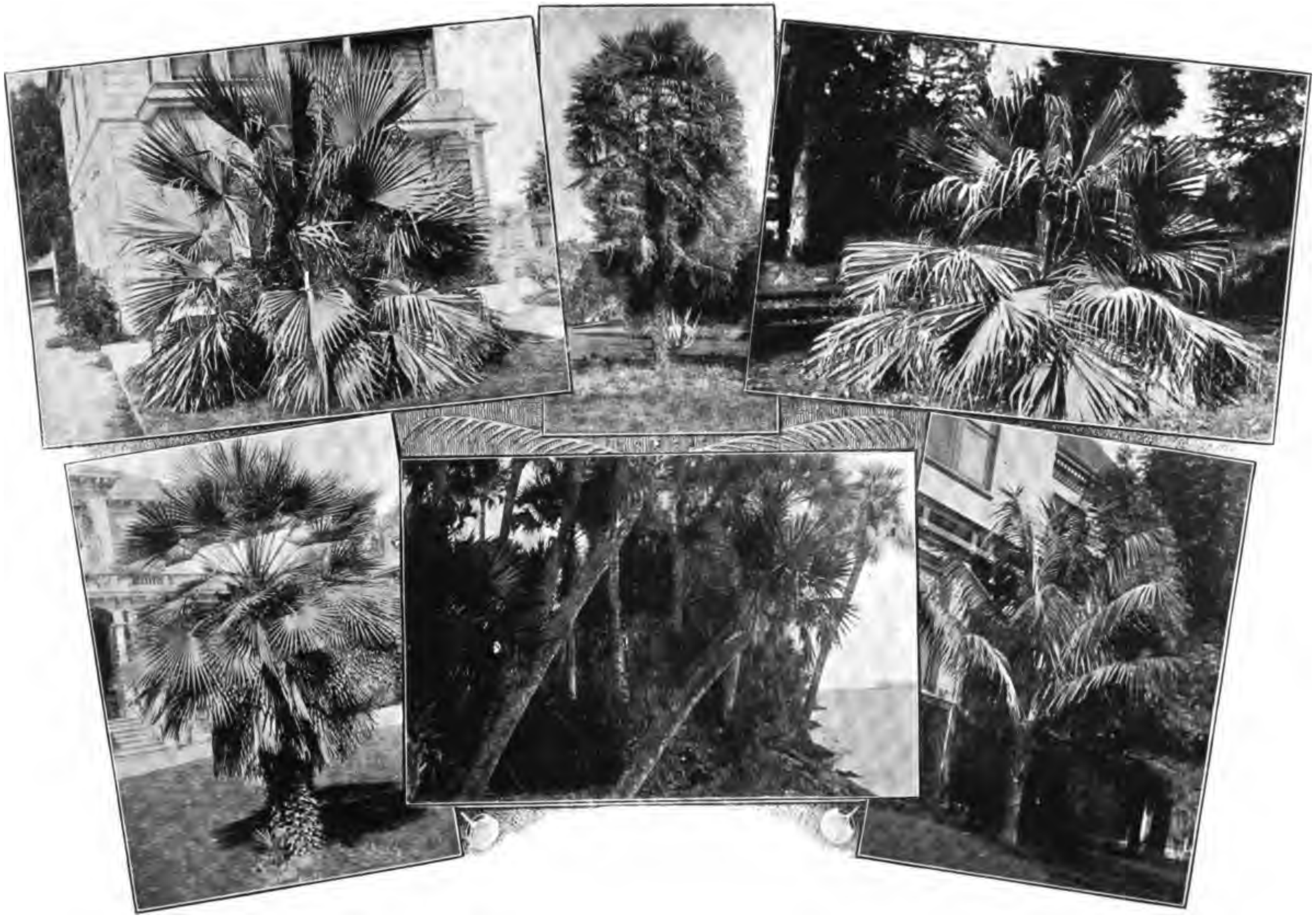


Plate XXIV. Palms.

Center, Palmetto, on the Indian river, Florida. The others are from Los Angeles: upper left-hand corner, *Erythea edulis*, in fruit; lower left-hand, *Chamærops humilis*; top center, *Trachycarpus excelsus*, 30 years old; upper right, *Livistona Chinensis*; lower right, *Howea Belmoreana*.

The above comprise all the Panaxes known to have been offered in the American trade, but there are many novelties in Old World collections, which may appear here at any time. The garden plants are often named before they have bloomed, and are therefore sometimes referred to the wrong genus. Some of the names are here given: *P. crispàtum*, Bull. Dwarf: lvs. triangular, pinnate, the lfts. deeply incised and toothed, the lateral ones overlapping. Brazil.—*P. Deleauànum*, Hort., is properly P. fruticosum, var. Deleauanum, N. E. Brown. A remarkable variation with digitate lvs., the divisions ternate or 2-ternate, the ultimate segments variable, but cuneate at base, toothed and cut and white-toothed. Polynesia, I.H. 30:492. Known also as Aralia Deleauana.—*P. diffùsum*, Bull. Form of P. fruticosum, with bright green, crisped lfts., which are linear-oblong and spiny-toothed. Polynesia.—*P. dissèctum*, Bull. Erect, branching, the 2-pinnate lvs. drooping, the lfts. cuneate-obovate and toothed and often 2-lobed.—*P. dumòsum*, Bull. Short-stemmed: lvs. roundish ovate, pinnately divided, the variable ultimate divisions spine-toothed.—*P. fissum*, Bull. Stem marked with pallid spots: lvs. 3-pinnate, the lfts. linear-lanceolate and whitish toothed. Polynesia.—*P. Mastersiànum*, Sander. Of climbing habit, with long-stalked drooping pinnate lvs. about 3 ft. long, the petiole greenish, tinged with pink and marked with white, the lfts. oblong-lanceolate and toothed. Solomon islands. G.C. III. 23:242.—*P. multifidum*, Hort., is properly P. fruticosum, var. multifidum, N. E. Brown. Compact plant, with 3-pinnatisect lvs. and linear or linear-lanceolate segments ½ in. or less long, with bristly teeth.—*P. Múrrayi*, Muell. (Aralia splendidissima, Hort.). Tree in its native place, with drooping, shining green pinnate lvs. 3-4 ft. long, and many oblong-lanceolate lfts. 3-6 in. long: umbels of brownish fls. in long, terminal panicles. S. Sea islands, Austral. B.M. 6798.—*P. ornàtum*, Bull. Lvs. long, pinnate, the lfts. narrow-lanceolate and deeply blunt-toothed. Brazil.—*P. sessiliflòrum*, Rupr. & Max., is described in Acanthopanax, its proper genus.
L. H. B.

PANCRÀTIUM (Latin, *all-powerful;* referring to supposed medicinal value). *Amaryllidàceæ.* Pancratiums and Hymenocallis, sometimes called Spider Lilies or Spirit Lilies, form a beautiful group of bulbs, hardy or tender, some blooming in winter, others in summer, and all characterized by the singular and beautiful floral structure known as a staminal cup and pictured in Vol. II at page 788. This cup is white and has the texture of petals. It is fringed or toothed in a great variety of ways. The filaments growing out of the cup are long or short. The perianth segments are generally long, slender and gracefully recurved. Thus many fanciful variations of the Spider Lily type are produced.

The names of these charming plants have been shifted back and forth between Pancratiums and Hymenocallis until horticulturists have come to despair. The latest monographer of the Amaryllis family (J. G. Baker, in Handbook of the Amaryllideæ, 1888), distinguishes the two genera as follows: Pancratium has many ovules in a cell and the seeds are black and angled by pressure; Hymenocallis has few ovules in a cell, and the seeds are usually solitary, large, and with a thick, green, spongy coat. Pancratium is an Old World genus: Hymenocallis is a New World genus, *H. Senegambica*, an African species, being an exception.

For generic description and culture, see *Hymenocallis*. Also notes by Miss L. Greenlee in Vick's Mag. 20:181, where, however, the picture labeled *P. ornatum* probably represents *P. ovatum*, which is *Hymenocallis ovata*.

A. *Perianth-tube 1-3 in. long.*

B. *Staminal cup small, 3-4 lines long.*

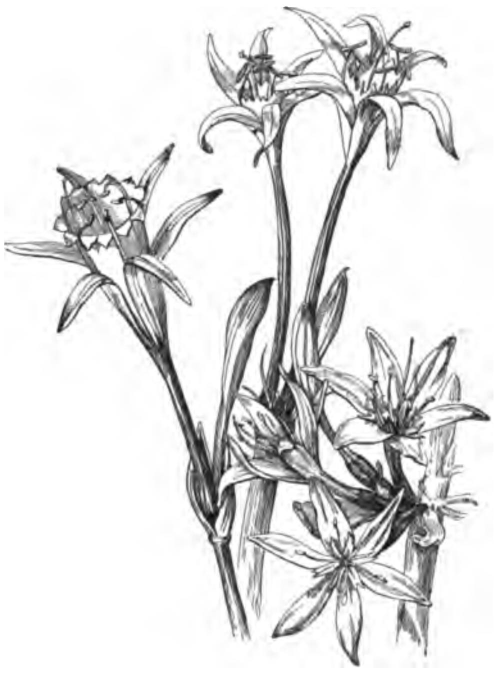
Illýricum, Linn. Fig. 1629. Lvs. 5-6, strap-shaped, glaucous, 1½-2 in. wide: scape 1 ft. or more long: fls. 6-12 in a centripetal umbel; perianth-tube 1 in. long; segments 1½ in. long; staminal cup with long, narrow, 2-cut teeth; free portion of filaments 6-9 lines long: seeds not compressed. Summer. Corsica, Sardinia, Malta, S. Italy. B.M. 718. Gn. 48, p. 246.—Hardiest, commonest and best.

BB. *Staminal cup large, 1 in. long.*

marítimum, Linn. Fig. 1629. Lvs. 5-6, linear, glaucous, persistent, finally 2-2½ ft. long: fls. very fragrant; perianth-tube 2-3 in. long; staminal cup very prominent, the teeth short, triangular and regular; free part of filaments 3 lines long. Spain to Syria. B.R. 2:161.

AA. *Perianth-tube 5-6 in. long.*

tortuòsum, Herb. Same section as *P. verecundum*, shown in Fig. 1629, but not in the trade. Lvs. 6-12, linear, spirally twisted: fls. 2-4 in an umbel; staminal cup over 1 in. long, distinctly toothed between the short free tips of the filaments. Autumn and winter. Arabia and Egypt.



1629. Pancratium: types of three sections of.

At the right, the short perianth-tube and small staminal cup of *P. Illyricum*. At the left, the relatively short tube and large cup of *P. maritimum*. At the top, the long tube and small cup of *P. verecundum*, to which *P. tortuosum* is very closely allied. (From B.M. and B.R.)

P. Amáncæs, Ker.=Hymenocallis Amancæs.—*P. amœnum*, Andr.=H. ovata.—*P. calathìnum*, Ker.=H. calathina.—*P. Caribǽum*, Linn.=H. Caribæa.—*P. coronàrium*, Le Conte=H. crassifolia.—*P. floribúndum*, Hort. Saul, 1893, is not accounted for by Baker.—*P. fràgrans*, Salisb.=H. ovata, but P. fragrans, Willd.=H. Caribæa.—*P. Galvestonénse*, Hort., presumably=H. Galvestonensis.—*P. Hárrisii*, Hort., is presumably H. Harrisiana.—*P. littoràle*, Jacq.=H. littoralis.—*P. Mexicanum*=H. lacera.—*P. ovàtum*, Mill.=H. ovata.—*P. rotàtum*, Ker.=H. lacera.—*P. undulatum*, HBK.=H. undulata.
W. M.

PANDÁNUS (Latinized Malayan name). *Pandanàceæ.* SCREW PINE. Screw Pines are tropical plants often attaining the size of trees, and remarkable for their stilt-like aërial roots, and the perfect spiral arrangement of their long, sword-shaped lvs. Their general appearance is singular. See Fig. 1633. They hold aloft a few long, scarred, naked branches, each one of which is crowned by a tuft of lvs. The aërial roots gradually lift the trunks out of the ground, but they doubtless anchor the trees also. They are, however, difficult organs to explain. Pandanuses are also remarkable for their spines, which are rather small but very numerous, all the same size and arranged at regular intervals along the whole of each gracefully recurved sword-shaped leaf — a perfect expression of formal linear beauty.

Two species of Pandanus are of the first importance, *P. Veitchii* and *P. utilis*, the former variegated, the latter not. (See Figs. 1630-32.) Young plants of these are amongst the most popular of all foliage plants for home decoration. They are especially suited for fern pans and table decoration. They are grown to a very large extent by wholesale florists and palm specialists. Every conservatory has them, and occasionally *P. utilis* is grown to a considerable age and height for the sake of a perfect specimen of the spiral habit of growth on a large scale. See Fig. 1631. In the tropics *P. utilis* is as valuable to the natives as many palms. The fruits are edible, and the roots furnish fiber for ropes, baskets, mats and hats, as do also the leaves, which are used in making paper and nets. In Mauritius the leaves of *P. odoratissimus* are used to make the bags in which coffee, sugar and grain are exported.

Screw Pines are widely distributed in the tropics, but they are most plentiful in the Malay Archipelago.

1630. Pandanus Veitchii.

There are more than 50 species. Trees or shrubs, rarely stemless or prostrate herbs: trunk slender or robust: lvs. very long or moderately so. There is only one other genus in the order,—Freycinetia. This has numerous ovules in the locules, while those of Pandanus are solitary in the carpels. Also Freycinetias are usually scandent.

The botany of Pandanus is almost hopeless. Pandanus presents an acute example of the stock difficulties with foliage plants: flowers and fruits rarely produced in cultivation; no monograph; original descriptions scattered through many rare and costly books, and often faulty; geographical distribution too wide ever to permit them to be accounted for in one flora; fls. and fr. too complicated and out of the ordinary to describe within reasonable limits; species coming and going; mixtures in the trade. Even the standard botanical works are of little help to the horticulturist, for the two points of view have scarcely anything in common. But Pandanus has peculiar difficulties, for the plants are diœcious, and one never knows what the sex will be until the plants flower. There is a good horticultural review of Pandanus in Gn. 25, p. 134 (1884), but the best account is that written by W. H. Taplin for the Florists' Review 2:387, which has been revised for the present occasion by Mr. Taplin. W. M.

In general, the species of Pandanus are not difficult to manage and under favorable conditions they are rapid growers. They require a high temperature, 65–70°, and little or no shading during the winter months, especially for the variegated kinds. A satisfactory soil is good loam enriched with old manure. As the plants make many coarse roots, it is best not to pot them too firmly, and during the summer to give them abundance of water. If the atmosphere is moist there is little need for syringing overhead, and particularly during winter. Overwatering, if coupled with an accidental low temperature, may lead to an attack of "spot."

Certain species, as *P. Veitchii*, produce suckers freely. Cuttings of these root easily at any season. Rooting is hastened (as in the case of the pine-apple) by keeping the cuttings somewhat on the dry side until they are callused, meanwhile giving them a fair amount of bottom heat.

P. utilis is propagated by seeds, which are a regular commodity and sure to germinate well. Seeds should be planted in light soil and placed in a warmhouse. The seeds should be set "bottom up," as this is the end from which the germs emerge. The seeds are odd-looking, being closely set in a more or less globular mass that hangs down on a stout stem, while the individual seeds, or rather fruits, are compound and often contain 8 or 10 germs, the latter being inclosed in cells of a tough, horny substance within the body of the fruit. Some gardeners soak the seeds before planting, but the writer has found no gain after soaking seeds of *P. utilis* for 48 hours in tepid water.

P. Veitchii is one of the very best variegated plants for decorative purposes. Its endurance as a house plant depends largely on the conditions under which it has been grown. Soft and sappy specimens are liable to rot.

P. utilis is second in importance in the trade, but is usually obtainable in much larger quantities owing to the readiness with which the seeds may be obtained and germinated. Plants in 3-inch pots, 8 inches high, retail at about 25 cents; plants in 6-inch pots, 18 inches high, about $1. Handsome specimens 3 feet or more high, with the screw character well developed, are worth from $5 to $10. *P. utilis* is a rapid grower and requires generous treatment as regards soil and water, and gives little trouble unless spot develops. The spot is caused by the burrowing of a minute insect in the leaf. Its progress seems to be favored by overwatering. Badly affected plants should be thrown away, as they are likely to be permanently disfigured. In case of a light attack, keep the plants somewhat drier and dose them with sulfur.

Among variegated kinds *P. Candelabrum*, var. *variegatus*, is perhaps second in beauty only to *P. Veitchii*, but, unfortunately, it is too spiny and the spines on the lower side are reversed, so that the plant is difficult to handle. It suckers freely.

Among dwarf kinds *P. graminifolius* excels. It is only 2–3 ft. high when fully developed, and it is at its best in a 4- or 5-inch pot. It is suitable for the center of fern pans and is readily increased by cuttings.

For large specimens *P. heterocarpus* is a noble plant. It is rather susceptible to overwatering in winter. The writer has never seen it produce suckers. The same is true of *P. Vandermeeschii*. Theoretically, any Pandanus will produce suckers if one has the patience to wait for them to develop on old specimens, or if the central growth be cut out.

Among the more spiny kinds *P. reflexus* is unique in habit, the leaves of a well-grown plant being so much recurved as to hide the pot.

P. Baptistii and *P. caricosus* are newer sorts. The former is variegated. *P. caricosus* is dwarfer than *P. Baptistii*, and has narrow, green leaves but little armed with spines. It branches freely and might be briefly described as a very strong *P. graminifolius*, though perhaps less useful for trade purposes.

W. H. TAPLIN.

Pandanus Sanderi, or as it has been termed the "Golden Pandanus," will not only become a great rival to the popular *Pandanus Veitchii*, but will, as soon as it is introduced and can be produced in quantity, outrank it as a commercial plant on account of its more decided, intense and attractive markings. The variegation of *P. Sanderi* is of a pleasing creamy yellow, distributed in some instances with alternate bands of green, while in others the half of an entire leaf will be marked with this creamy yellow variegation, while the young growth in the center assumes an orange bronze color. The entire plant is suffused with a golden sheen in a manner difficult to describe.

The variegation throughout the plant is more decided than in *P. Veitchii*; this especially appears to be the case in larger-sized specimens, say in plants 3 to 4 feet high, where the lower or older leaves attain a much more brilliant color, while in *P. Veitchii* this lower foliage loses much of its original brightness, and under ordinary circumstances frequently turns entirely green.

The growth of the plant also appears more graceful, the leaves being recurved in a more pleasing manner, and suckers very freely. J. D. EISELE.

INDEX.

Baptistii, 3.
Candelabrum, 2. 14,
caricosus, 11.
Forsteri, 6.
Fosterianus, 6.
furcatus, 9.
graminifolius, 8.
heterocarpus, 10.
Javanicus, 2.
odoratissimus, 12.
ornatus, 10
pygmæus, 7.
reflexus, 13.
Sanderi, 4.
utilis, 5.
Vandermeeschii, 15.
variegatus, 2, 12.
Veitchii, 1.

A. *Foliage variegated.*
  B. *Lvs. variegated with white.*
    C. *Midrib not white*........... 1. **Veitchii**
    CC. *Midrib white*............... 2. **Candelabrum var. variegatus**
  BB. *Lvs. variegated with yellow.*
    C. *Yellow stripe down the center*...................... 3. **Baptistii**
    CC. *Yellow stripes alternating with green*............... 4. **Sanderi**
AA. *Foliage not variegated.*
  B. *Spines reasonably short.*
    C. *Habit of lvs. stiff, erect.*
      D. *Color of spines red*...... 5. **utilis**
      DD. *Color of spines yellowish green*.................. 6. **Forsteri**
    CC. *Habit of lvs. more or less recurved: color of spines usually white.*
      D. *Growth dwarf*........... 7. **pygmæus**
      8. **graminifolius**
      DD. *Growth strong*........... 9. **furcatus**
      10. **heterocarpus**
      11. **caricosus**
      12. **odoratissimus**
  BB. *Spines disagreeably long.*
    C. *Habit of lvs. very much reflexed*.....................13. **reflexus**
    CC. *Habit of lvs. more or less recurved*...................14. **Candelabrum**
    CCC. *Habit of lvs. stiff, nearly erect*.....................15. **Vandermeeschii**

1. **Vèitchii**, Hort. Fig. 1630. Lvs. 2 ft. long, broader than in *P. utilis*, somewhat recurved, spiny, dark green in the center, margined with broad bands of white. Polynesia. A.F. 4:570. F. 1871, p. 177. Gn. 2, p. 501.

2. **Candelàbrum**, var. **variegàtus**, Hort. (*P. Javánicus*, var. *variegàtus*, Hort.). Lvs. 3–6 ft. or more long, margined white; marginal spines white; spines on the midrib of the lower surface reversed. Java. F.R. 2:389. V. 9:20. Lowe 36.—Perhaps ranks second in beauty only to *P. Veitchii*, but unfortunately it is too spiny. Lvs. drooping, narrower than in *P. Veitchii*. See No. 14.

3. **Báptistii**, Hort., offered by Saul and Pitcher & Manda; has a yellow stripe down the center. Taplin says it is a rapid grower. Not in Index Kewensis.

4. **Sánderi**, Hort. Sander. Habit tufted: lvs. 30 in. long, with minute marginal spines, not unlike those of *P. Veitchii* but of denser habit, and differing much in the variegation, which in this case is golden yellow, and in place of being confined to the margin, or nearly so, it is distributed in narrow bands of yellow and green in alternation throughout the length of its leaf. G.C. III. 23:249. R.H. 1898, p. 230. G.M. 41:686. A.G. 19:455.—Taplin says it is a rapid grower.

5. **ùtilis**, Bory. Figs. 1631–3. Attains 60 feet in Madagascar: lvs. glaucous, erect, 1–2¾ ft. long, spines red. Madagascar. Here may belong I. H. 7:265 (*P. mauritianus*); B.M. 5014 (*P. Candelabrum*); R.H. 1866:270 (*P. flagelliformis*, or *flabelliformis*). A.F. 4:571.—Nicholson refers *P. odoratissimus* to *P. utilis*.

6. **Fórsteri**, Moore (*P. Fosteriànus*, Hort. Siebrecht). Lord Howe's Island. Better accounted for in Voss' scheme on next page.

7. **pygmæus**, Thore. Low, spreading shrub, not over 2 ft. high in the center, but sending out from the base numerous horizontal, rooting, annulated branches: lvs. about 4 ft. long, spirally arranged in 3's, linear-subulate, with a clasping base; margins and keels fringed with small white spines. Mascarenes. The above description taken from B.M. 4736, which is a doubtful specimen.

8. **graminifòlius**, Kurz. Lvs. 12–18 in. long by 3–4 lines wide; marginal spines minute, straight. Burma. *P. graminifolius* of the trade has never been carefully distinguished from *P. pygmæus*, and, according to Nicholson, it is a species of Freycinetia. F.R. 2:388, where Taplin says it has a tufted, much-branched habit, dark green lvs. about ½ in. wide, not so stiff as most species; spines short, whitish.

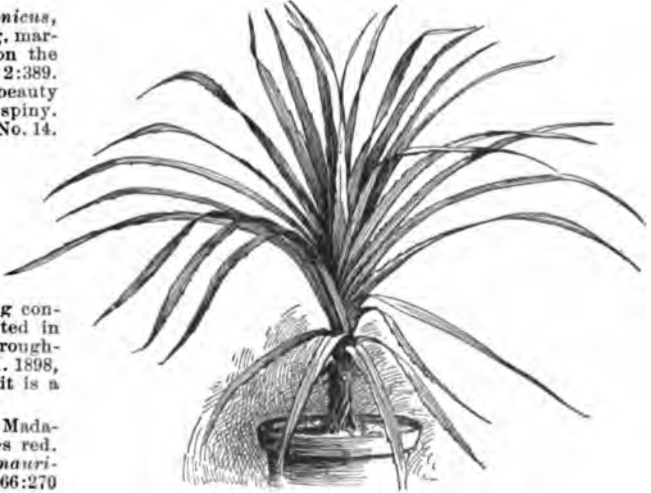
9. **furcàtus**, Roxb. Tree, attaining 30–40 ft.: lvs. 15–20 ft. long, somewhat glaucous beneath; spines 1–2 lines long, curved. India. R.H. 1879:290; 1881, pp. 174, 175.

10. **heterocárpus**, Balf. f. Branching tree, with slender trunk, very numerous roots and spreading branches: lvs. lanceolate-acuminate, dilated and clasping at the base, erect-spreading, leathery, strict, greenish, often somewhat glaucous at the base, rather flat margin covered with small red, slightly incurved spines; lower midrib furnished from the middle with distant spines of the same character. Mascarene Islands.—A very variable species, approaching *P. utilis*, but distinguished by habit. Taplin says that *P. ornatus* of the trade is synonymous with *P. heterocarpus*: "Strong-growing, with broad, dark green foliage; spines white; under side of lvs. slightly glaucous."

11. **caricòsus**, Spreng. Shrub: lvs. 5–8 ft. by 2–2½ in., slightly glaucous; spines minute, white, relatively few: male inflorescence erect. Moluccas. R.H. 1878, p. 405. —Offered by Van Geert, of Belgium.

12. **odoratissimus**, Linn. f. Height 20 ft.: lvs. light green, 3–5 ft. long; spines short, white. India, Arabia. G.C. III. 17:14.—A scent which is much esteemed in Java is obtained from the male fls. The above description is from Nicholson. The species is not satisfactorily accounted for in the Flora of British India. Var. **variegàtus**, Hort., secured by Reasoner from the West Indies, is identical with what the florists call *P. Javanicus*.

13. **refléxus**, Lodd. Lvs. more completely recurved than in other common species, 5–6 ft. long, dark green, shining; spines long, white, those on the midrib of the lower side reversed. Mascarene Islands. F.R. 2:387. —Adv. 1895 by Pitcher & Manda.



1631. Pandanus utilis.

A young Screw Pine just beginning to show the spiral character.

14. **Candelàbrum**, Beauv. CANDELABRUM TREE. CHANDELIER TREE. Tree, attaining 30 ft. "Lvs. 3 ft. by 2 in., dark green; spines brown" (Nicholson). Trop. Africa. B.M. 5014 is doubtful, referred to *P. utilis*.—Not

advertised in Amer., but for the popular variegated form, see No. 2.

15. **Vandermèeschii,** Balf. f. Lvs. stiff, suberect, 2½–3 ft. long, 1½–2 in. broad, very glaucous; margins red and thickened; spines strong, red; midrib red, prominent, spiny. Attains 20 ft. in Mascarenes. G.C. III. 18:237.—Taplin says it is stouter and usually more upright than *P. Veitchii;* its lvs. are dark green and the plant does not produce suckers. The spelling Vandermeerschii is probably incorrect.

ANOTHER VIEW OF PANDANUS.

In the third edition of Vilmorin's Blumengärtnerei, Voss gives a very different treatment of Pandanus. It has every evidence of being based upon living plants in German conservatories. A portion of it is here translated and rearranged. Voss makes the species-endings feminine because of the old Latin rule about the gender of trees.

INDEX TO VOSS' SCHEME.

Candelabrum, 3.
caricosa, 2.
Forsteri, 1.
furcata, 2.
graminifolia, 6, 7.
Javanica, 8.
lævis, 5.
Madagascariensis, 1.
nitida, 7.
odoratissima, 1, 5.
ornata, 4.
pygmæa, 6.
reflexa, 4.
utilis, 1.
Vandermeeschii, 1.
Veitchii, 8.

A. *Young plants with unbranched stems.*

B. *Upper side of lvs. flat on each half.*

1. **ùtilis,** Linn. (*P. odoratissima*, Jacq.). Margin of lvs. purplish red, strongly spiny: lower side of lvs. with a keel. Var. **Madagascariénsis,** Van Houtte (*P. Vandermeeschii*, Balf.). Lvs. thickly white-powdered at the base. *P. Forsteri*, Moore, from Lord Howe's Island: lvs. light green and shining above, bluish green beneath; spines yellowish green.

BB. *Upper side of lvs. more or less keeled on each half.*

2. **furcàta,** Roxb. (*P. caricòsa*, Hort.). A fast grower; large specimens occasionally flower in German conservatories and then branch. Lvs. light green; spines lighter, marginal ones erect, those of the keel below recurved.

3. **Candelàbrum,** Beauv. In this and No. 2 the stems are thin and the aërial roots very thick. Lvs. blue-green; spines light colored, tipped brown. The inference is that this species is distinguished from No. 2 by the spines of the lower keel not being recurved.

1632. Young specimen of Pandanus utilis.
(Rather narrower-lvd. than the type).

AA. *Young plants with scarcely any stem.*

4. **refléxa,** de Vriese. Lvs. strongly reflexed; spines on margin and lower keel strong; no keels above. *P. ornàta*, Lam., lacks the spines on the lower keel, but is otherwise the same.

1633. Pandanus utilis.
An old Screw Pine in the tropics. (Adapted from The Garden.)

AAA. *Young plants freely branched from the ground.*

B. *Spines absent or only a few at the apex of lvs.*

5. **lævis,** Roxb. (*P. odoratissima*, Noronha). (Not adv. in America, but inserted because of its synonym and the interest attaching to a spineless Pandanus.)

BB. *Spines present and sharp.*

C. *Upper side of lvs. flat on each half.*

6. **pygmæa,** Thouars (*P. graminifòlia*, Hort.). Dwarf, and densely bushy, with many aërial roots: lvs. dark green; marginal spines whitish.

CC. *Upper side of lvs. more or less keeled on each half.*

7. **nítida,** Kurz. (*P. graminifòlia*, Hort.). Shrubby, attaining 8 ft. Lvs. remarkably shiny on both sides; the lower keel lacks spines.

8. **Javánica,** Hort. Bushy: lvs. dark green above, only slightly shining, beautifully striped with white; marginal spines straight; spines of the lower keel bent back. *P. Veitchii*, Lem. Lvs. shining on both sides, striped yellowish white, sometimes all yellowish white; spines not half as long as in *P. Javanica.* W. M.

PANICULÀRIA (Latin name referring to the panicled spikelets). *Glyceria* of the trade. *Gramineæ.* A large genus of swamp grasses inhabiting all parts of the temperate zone, and characterized by ample panicles, many-fld. spikelets with only the 2 lower glumes empty; the others firm in texture, obtuse, strongly 5–7-nerved, rounded on the back, and without cobwebby hairs; styles present. Only the following are in the American trade:

Americàna, MacM. (*Glycèria grándis*, Wats., also Hort. *Glycèria aquática*, Amer. authors). REED MEADOW-GRASS. Tall, erect and stout (3–5 ft. high), glabrous: lvs. large and broad (3–8 lines broad), spreading: panicle very large (8–15 in. long), mostly dark brown, its branches long and spreading: spikelets 4–7-fld., 2–3 lines long: flowering glumes 1 line long. North America. —Good for planting in wet places for the margins of aquatic gardens, etc.

nervàta, Kuntze (*Glycèria nervàta*, Trin., also Hort.). NERVED MANNA-GRASS. Lower and more slender (1–3 ft. high), erect, glabrous: lvs. much smaller (2–3 lines wide): panicle 3–8 in. long, greenish, its branches long and spreading: spikelets 3–7-fld., 1–1½ lines long; flowering glumes three-fourths of a line long. North America.—A graceful native grass growing in damp ground or shady places. K. M. WIEGAND.

PÁNICUM (old Latin name of Italian millet, *Setaria Italica*, said to be derived from *paniculum*, a panicle; alluding to the usual form of the inflorescence). *Gramineæ*. An immense genus of grasses scattered over the world, especially in the tropics. Several hundred species have been described, while conservative authorities place the number at about 300. Several of our bad weeds belong to this genus, such as crab grass (*P. sanguinale*), and barnyard grass (*P. Crus-galli*), also several food plants, as Indian millet (*P. miliaceum*), Sonwa millet (*P. frumentaceum*), and Shama millet (*P. colonum*). Their importance as forage grasses is very insignificant when the number of species is taken into consideration. This is largely from the fact that the species, as a rule, are not gregarious, and to the fact that they are not well represented in the meadows and prairies of temperate and northern regions. An important forage grass of the warmer regions is, however, guinea grass (*P. maximum*). Spikelets with one terminal perfect flower, and below this a second flower which may be staminate, neutral or reduced to a glume; therefore 4 glumes, the 2 lower and often the third being empty. The flowering glume is characterized by being of a much firmer texture.

virgàtum, Linn. An upright grass with stiff culms, 2–6 ft. high: spikelets in loose, compound panicles, usually more or less purplish, sharp-pointed; first glume half as long as spikelets, 5–7-nerved, second and third glumes of about equal length, 5–7-nerved. A hardy perennial used for ornamental purposes. Native of eastern U. S. R.H. 1890, p. 525; 1896, p. 572. M. 14, p. 215; 29, p. 235; 37, p. 245.

sulcàtum, Aubl. A tall perennial, 4–6 ft., native of tropical America: lvs. large, 1 in. or more broad, somewhat hairy, conspicuously plicate: panicle narrow, about 1 ft. long, with many ascending branches, bearing short-pedicelled spikelets throughout their length, and also scattered bristles: spikelets pointed: lower glume one-half, second glume two-thirds the length of third and fourth, all strongly nerved.

plicàtum, Lam. Called "palm grass" in the South, where it is cultivated for ornament. Native of East Indies. Resembles the preceding, but lvs. broader and nearly smooth, and panicle larger and more bristly: spikelets similar. R.H. 1862, p. 290; 1896, p. 572. Gn. 12, p. 517; 31, p. 487; 37, p. 245.—Woolson, of Passaic, N. J., says it grows 4–6 ft. high in the hardy border and makes a fine stately grass; useful for winter bouquets. A variegated form is figured in F.S. 17:1743 under the name *folius niveo-vittatis*.

Crus-gálli, Linn. BARNYARD GRASS. The cultivated form is known as Japan Barnyard millet. The ordinary form is a weed in cultivated soil. The form in the trade is used for fodder. Another form or closely allied species (*P. frumentaceum*) is used in India for its grain. Panicle made up of numerous dense alternate spikes: spikelets crowded on two sides of a 3-sided axis: second and third glumes more or less awned. Annual.

capillàre, Linn. OLD WITCH GRASS. A common native annual grass and weed, recommended for cultivation on account of its ornamental purple panicle, which is ample and loose, the spikelets being borne on slender hair-like pedicels. R.H. 1890, p. 525; 1896, p. 572.

miliàceum, Linn. TRUE MILLET. BROOMCORN MILLET. Spikelets all pedicellate in an umbel-like, drooping panicle, each with 3 empty glumes and 1 flower.—A tall annual grass (3–4 ft.) with soft lvs., grown for fodder, but not in common use in this country. Cultivated from prehistoric times. Grown somewhat extensively in China and Japan, and southeast Russia. Native country unknown, but probably East Indies. More fully discussed in Farmer's Bulletin, No. 101 U. S. Dept. Agric. What is usually grown in the United States under the name of Millet is *Setaria Italica* and its varieties.

P. variegàtum=Oplismenus Burmanni. For *P. Germanicum*, see Setaria. A. S. HITCHCOCK.

PANSY. The Pansy is everywhere a familiar flower. There is much character in it. The flower is often likened to a face. It appeals to personal feeling. In fact, the word Pansy is only a corruption of the French *pensée*, meaning thought. The old folk-name, heart's-ease, is also associated with the familiar place which the plant has occupied; it signifies remembrance. The Pansy is one of the oldest of garden flowers. Parkinson mentions it as a flower-garden subject in 1629. When critical study began to be given to the kinds of plants, the Pansy was so distinct from wild species that its specific identity could not be determined with precision, and, in fact, this is the case to the present day. It is generally considered, however, that it has descended from *Viola tricolor* (see *Viola*), a small perennial violet native to the cooler parts of Europe. In its nearly normal or unimproved forms. *Viola tricolor* is now grown in gardens. Fig. 1634. It is a most interesting plant, because handsome-flowered and variable. The flowers of this violet usually have three colors or shades, mostly blue, whitish and yellow, but in the different varieties one of the colors strongly predominates. A form with very small and inconspicuous flowers (var. *arvensis*) has run wild in many parts of the country.

1634. Viola tricolor.
Nearly or quite the original form of Pansy.

Pansies are perennial, but they are grown practically as winter or spring annuals. Commercial growers sow the seeds in fall, and sell great quantities of the seedling plants before winter sets in. These plants are bloomed in frames or cold greenhouses, or they are planted in the open for spring bloom. Plants are also started indoors in late winter for spring bloom. Pansies delight in cool, moist weather; hence the American summer is not to their liking, and they usually perish. A new stock of plants is started every year.

The modern improved Pansies run in strains or families rather than in definite varieties. These strains are maintained at a high grade by the best cultivation and the closest attention to selection. The seed of the best strains is necessarily expensive, for it represents much human care. The stock usually runs down quickly in other hands. It should be renewed from the seed-breeder each year if the best results are to be maintained. These fancy and high-bred strains require extra care in the growing. Most of the best strains are of European origin. They are usually known by the name of the breeder. The chief points of merit in the high-bred Pansy are size of flower, brilliancy of coloring, arrangement of colors. The flowers may be self-colored (of only one color) or parti-colored. The parti-colored flowers are of three general types: 2 banner petals and 3 central petals of different colors; petals all margined with lighter color; petals all striped. There are all grades of intermediate differences. The colors which are now found in Pansies are pure white, purple-black, pure yellow, different shades of blue, purple, violet, red-purple. Pansy flowers are now grown 3 in. across. Fig. 1635.

With the above account may be compared Gerard's description of Pansies in 1587. He pictures the Hearts-ease or *Viola tricolor* with small violet-like flowers, the petals standing apart from each other. The "Upright Heartsease," or *Viola assurgens tricolor*, is represented as a stouter and more erect plant, with rounder but scarcely larger flowers. These are described as follows: "The Hearts-ease or Pansie hath many round leaves at the first comming up; afterward they grow somewhat longer, sleightly cut about the edges, trailing or creeping upon the ground: the stalks are weake and tender, whereupon grow floures in form & figure like the Violet, and for the most part of the same bignesse, of three sundry colours, whereof it tooke the syrname *Tricolor*, that is to say, purple, yellow and white or blew; by reason of the beauty and braverie of which colours they are very pleasing to the eye, for smel they have little or none at all. The seed is contained in little knaps of the begnesse of a Tare, which come forth after the floures be fallen, and do open of themselves when the seed is ripe. The root is nothing else but as it were a bundle of threddy strings.

"The upright Pansie bringeth forth long leaves deeply cut in the edges, sharp-pointed, of a bleake or pale green colour, set upon slender, upright stalks, cornered, jointed, or kneed a foot high or higher; whereupon grow very faire floures of three colours, viz., of purple, blew and yellow in shape like the common Hearts-ease, but greater and fairer; which colours are so excellently and orderly placed, that they bring great delight to the beholders, though they have little or no smell at all: for oftentimes it hapneth that the uppermost floures are differing from those that grow upon the middle of the plant, and those vary from the lowermost, as Nature list to dally with things of such beauty. The seed is like that of the precedent."

L. H. B.

The Pansy is truly a "plant for the million." Its ease of cultivation, hardiness and cheapness have made it one of the most popular plants in this country. The undersigned is inclined to believe that as many plants of Pansies are sold as of all other plants.

1635. Modern Pansies. Nearly ½ natural size.

Pansies were first improved from the original type in Great Britain, where the cool and moist climate is well adapted to their cultivation, and new varieties were gradually brought out with larger flowers of varied colors. For many years England and Scotland bore the reputation of growing the best Pansies. About twenty-five years ago, however, three French specialists, Bugnot, of St. Brieuc, and Cassier and Trimardeau, of Paris, made immense strides in developing the Pansy, and their productions were a revelation to the horticultural world. Such sizes and colors were previously thought impossible. Trimardeau created a new race with immense flowers and very hardy constitution. His strain crossed with those of Cassier and Bugnot has given a Pansy which is superseding the older English varieties. It must be admitted, however, that the best results can be obtained only at the expense of much care and cultivation and selection, and specialists only can be expected to reach the greatest degree of perfection. The strains degenerate very soon unless constant attention and care are bestowed on the plants. Contrast the flowers grown by Cassier and Bugnot themselves with the strains sold nowadays generally under their names! The choicest flowers are removed so far from the type that they produce but little seed and that of short vitality. The seed has to be gathered by hand, and it is necessary to go over the seed-beds every day. With the cheap and common strains less careful methods of seed-gathering are used. At the time of harvesting the plants are all pulled out and laid in the shade for the seed to slowly ripen, when the seeds are all cleaned at once.

In this country, with more extremes in temperature, more care must be exercised than in Europe in the selection of localities and exposure, and with the best of care Pansies will not last very long in bloom. A position sheltered from high winds and exposed to the morning sun will be found the most favorable, and soil of a clayish nature well enriched will grow the best Pansies. Frequent sprinklings also, to keep the ground and foliage moist, will be of great benefit. The general sowing for the production of early spring bloom is made out of doors in August, while seeds sown indoors from February to June will produce plants to flower intermittently during late summer and the fall months.

When sowing Pansy seed on a considerable scale in August, sow the seed broadcast in a seed-bed out of doors, cover very lightly with fine soil or well-rotted manure, and press the seed in with a small board; then mulch the seed-bed with long, strawy horse manure, from which the small particles have been shaken off, to the thickness of one inch, so as to have the soil well and evenly covered. At the end of two weeks the plants will be up. Then remove the straw gradually, a little at a time, selecting a dull day if possible. Keep the bed moist. This process for germinating Pansy seed is recommended by Cassier, and the undersigned from his own experience recommends it above all others. In England and Scotland the choicest varieties are perpetuated by means of cuttings, but it seems to be impossible to maintain the size for any length of time by this means in North America.

If Pansies are desired for winter bloom, plant them as soon as they are large enough on beds or benches near the glass in the greenhouse. The temperature for violets suits them very well. They are grown to a slight extent for cut-flowers.

If wanted for exhibition purposes, keep them in a lower temperature till January; some freezing, even, will benefit them. Start them slowly into growth at a temperature of between 30–40° at night, as a higher temperature will diminish the size of the flowers. A weak solution of guano or hen manure once every two weeks will help them wonderfully. Flowers 4 in. across can be grown for exhibition. During growth and bloom maintain a rather low, even temperature, without actual freezing, carefully avoiding extremes in temperature.

In favored localities Pansies designed for early spring bloom receive no glass protection during winter, the plants from the August sowing being transplanted in the fall from the seed-bed directly into their permanent quarters. Good Pansies can be grown out-of-doors without glass protection as far north as Nova Scotia. Generally, however, it is much better to winter Pansies in a coldframe, especially the finer strains. Pansies in bloom should be partially shaded from the hot midday sun, particularly the fancy-colored strains, the petals of which are more delicate in texture.

Denys Zirngiebel.

PAPÀVER (old Latin name of dubious derivation). *Papaveràceæ*. POPPY. Poppies rank among the most popular annual flowers in cultivation. From their astonishing range of color, and from the formidable list of names given below, one might suppose their botany very complicated. It is, however, easy to understand. There are only 4 species commonly cultivated and these are all remarkably distinct. They are (1) the Opium Poppy, (2) the Corn Poppy, (3) the Iceland Poppy and (4) the Oriental Poppy.

1. The Opium Poppy, *P. somniferum*, one of the commonest and the most variable. It is an annual, of tall, stately habit, and recognized at once by the glaucous hue of its foliage. The flowers are the largest of any of the annual species, but unfortunately they are useless as cut-flowers because they drop their petals.

2. The Corn Poppy of Europe, *P. Rhœas*, is also an annual, but a dwarfer plant, with green, hairy, finely cut foliage and smaller flowers. This is the delight of every American that visits Europe. The Shirley Poppies are the best strain of this species; in our gardens the flowers last longer than the common Poppies and the plants are neater when out of bloom.

3. The Iceland Poppy, *P. nudicaule*, is the glory of the Arctic regions. It ranges over an immense territory and varies remarkably both in the wild and the garden. Orange, red and white are the chief colors, besides shades of yellow, but the flowers never attain the brilliant scarlet of the Corn Poppy. Although the Iceland Poppy is a perennial, it is short-lived and is commonly treated as an annual. It is known for the satiny texture and crimpled character of its petals. The flowers are excellent for cutting, especially if the young flowers are selected and cut in the early morning, a principle which applies to many flowers often supposed to be useless for home decoration.

4. The Oriental Poppy, *P. orientale*, is a longer-lived perennial, and although it has the largest flowers of any species in the genus it has nothing like the fame of the Opium Poppy. However, it has the double advantage of being easily propagated by either seed or division, and it has a considerable range of color, which is said to be largely due to crosses with *P. bracteatum*. The latter may be only a botanical variety; it differs in having large bracts below the flower.

The other species are for the fancier. The Alpine Poppy, *P. alpinum*, was considered by Linnæus to be a distinct species from the Iceland Poppy. However, every gradation has been discovered between the typical form of *P. nudicaule* of the arctic regions and the common Poppy found in the Alps. The former has a yellow flower, while the common Alpine Poppy is white. Botanically, the Poppy of the Alps is generally regarded as an extreme form of *P. nudicaule*, characterized by a dwarfer habit and more finely divided foliage. **For horticultural purposes *P. nudicaule* and *alpinum* should be considered to be distinct species. The Iceland Poppy can be easily grown in the border,** while the Alpine Poppy demands rock-garden treatment. The former does best in a moderately rich and light loam, while the latter does better in a rather poor soil. Both need full exposure to the sun, and *P. alpinum* probably needs better drainage. The form of *P. alpinum* which has white petals with a green spot at the base may be considered the typical one. This is shown in color in Gn. 24:410, and also in Correvon's pocket guide to the wild flowers of the Alps, entitled *Flore Coloriée*, etc. Correvon states that the yellow-fld. form (var. *flaviflorum*) is found in the granitic Alps, the inference being that the white-fld. form is characteristic of the calcareous Alps. An orange-red Poppy is also found in the Alps and on the continent is often called *P. Pyrenaicum*. The tendency in England is to make it a variety of *P. nudicaule*. Whether all these plants are species or varieties and how they should be named are matters of opinion. The range of color has been indicated above. Aside from color, the important points on which these varieties are made and unmade are as follows: the degree of hairiness of stem and capsule; whether the hairs are appressed or spreading; the manner in which the foliage is cut, and the shape of the capsule, which varies from short, thick and subglobose to long, narrow and club-shaped.

Papaver is a genus of about 50 species, mostly natives of the Mediterranean region. There is, however, one in South Africa and another in Australia. Also a true Papaver has been discovered in California, and has been named *P. Californicum*. (The "California Poppy" of gardens is Eschscholzia.) Papavers are herbs with a milky juice, bristly or smooth and often glaucous: lvs. usually lobed or dissected: peduncles long: buds nodding: fls. every shade of red, violet, yellow and white; sepals 2; petals 4; stamens numerous; stigmatic lobes 4–many: capsule globose, obovate or top-shaped, dehiscing under the vertex by transverse pores between the placentæ; openings very small and valve-like.

Opium is made from the milky juice of *P. somniferum*, which oozes from shallow cuts made in the young capsules. The seeds have no narcotic properties and are sold for bird food under the name of "maw seed." They also produce a valuable oil.

1636. Poppies in the year 1613.

Five flowers from *Hortus Eystettensis*, (redrawn and reduced, indicating the antiquity of some of the main types that are popular today. *P. somniferum*.

Hybrids between annual and perennial plants are rare and interesting. "At the hybrid conference at Chiswick in July last, the late M. Henri Vilmorin, of Paris, gave a very interesting account of a successful attempt at hybridizing the Opium Poppy (*P. somniferum*) with *P. orientale* or *P. bracteatum*, the hybrids of which did not produce seed until they were again cross-fertilized with *P. orientale*, when a permanent race of showy plants that grow freely from seeds was obtained." *F. W. Burbidge*, in Gn. 56, p. 321 (1899).

1637. Oriental Poppy. Papaver orientale (× 1-5).

There is no garden monograph of Poppies, but the student may find an account of 38 species in Boissier's Flora Orientalis 1:105–118 (1867). The species are there arranged in 3 primary groups,—annuals, biennials and perennials. Ordinarily this is an excellent arrangement for the horticulturist, though not for the botanist. In the case of the Poppies it is not very useful. The duration of several kinds is doubtful, species which are annual in the South behaving as biennials in northern botanic gardens. Moreover, for garden purposes all Poppies are to be treated as annuals for best results, with the exception of *P. orientale* and *bracteatum*, which the gardener thinks of as one group. The Oriental Poppy is, in fact, the only long-lived perennial Poppy. The Iceland Poppy may live for several years, but after the third year it usually degenerates. It blooms the first year from seed and the best results are usually secured the second year.

The following account of Shirley Poppies is given by the Rev. W. Wilks in The Garden 57, p. 385: "In 1880, I noticed in a waste corner of my garden, abutting on the fields, a patch of the common wild field Poppy (*Papaver Rhœas*), one solitary flower of which had a very narrow edge of white. This one flower I marked and saved the seed of it alone. Next year, out of perhaps two hundred plants, I had four or five on which all the flowers were edged. The best of these were marked and the seed saved, and so on for several years, the flowers all the while getting a larger infusion of white to tone down the red until they arrived at quite pale pink and one plant absolutely pure white. I then set myself to change the black central portions of the flowers from black to yellow or white, and having at last fixed a strain with petals varying in color from the brightest scarlet to pure white, with all shades of pink between and all varieties of flakes and edged flowers also, but all having yellow or white stamens, anthers and pollen, and a white base." * * * Mr. Wilks then distributed it freely to all. "My ideal," he continues, "is to get a yellow *P. Rhœas*, and I have already obtained many distinct shades of salmon. The Shirley Poppies have thus been obtained simply by selection and elimination. * * *

Let it be noticed that true Shirley Poppies (1) are single, (2) always have a white base with (3) yellow or white stamens, anthers and pollen, (4) never have the smallest particle of black about them. Double Poppies and Poppies with black centers may be greatly admired by some, but they are not Shirley Poppies. It is rather interesting to reflect that the gardens of the whole world—rich man's and poor man's alike—are to-day furnished with Poppies which are the direct descendants of one single capsule of seed raised in the garden of the Shirley Vicarage so lately as August, 1880."

W. M.

There is no way in which the lover of color in flowers can gratify his taste so cheaply and so fully as by growing a good selection of Poppies. No other flower will make such a gorgeous show in the border during the months of July and the first half of August. To grow the finest Poppies, plant the seed as early in the spring as the ground can be worked. Cover very lightly, for if planted deep the seed does not germinate. The best way is to make the bed smooth and fine, scatter the seed thinly, then rake gently, and firm the soil well with a board or, better still, with the back of a hoe. When the plants are up 2 or 3 in., thin to 6 in. apart for the weaker growing varieties and 12 in. for the strong growing *P. somniferum*. Pick all the pods as soon as the petals drop, unless one desires to save seed. This treatment lengthens the blooming season and saves a lot of trouble the next year. The seed is quite hardy, and if left to ripen, the seedlings come up in countless numbers the following spring. An advantage of self-sown seed is that the plants bloom two weeks earlier than if planted in the spring. Poppies must always be planted where they are to bloom, as no annual Poppy will bear transplanting. Poppies are so susceptible to cross-fertilization that new strains are constantly arising. The ease with which they can be originated has led to much confusion in the seed catalogues.

P. somniferum, the Opium Poppy, is the commonest kind in cult. and is sufficiently described elsewhere.

P. Rhœas, the scarlet field Poppy of Great Britain, is the parent of many beautiful forms. Fig. 1638. Of these the best is the Shirley, the loveliest of all Poppies; the flowers are of the most delicate silky texture and in every imaginable shade and combination of white, pink, and red, with yellow anthers. Var. *umbrosum*, the Fire Dragon of some catalogues, is dark cardinal, with a black blotch at the base of each petal, and purplish black anthers. *P. lævigatum* resembles *P. umbrosum*, the fls. being the same color, but the black blotch is margined with white and the petals are more upright, not opening out so flat as in *P. Rhœas*. Sometimes *P. lævigatum* comes semi-double, but with this exception all the smaller double Poppies are forms of *P. Rhœas*. The ranunculus-fld. has all the gracefulness of the single form, with a wonderful diversity of color, white through pink to the deepest crimson, and in every degree of doubleness from 2 or 3 rows of petals to perfectly double. The varieties *umbrosum* and Shirley show a tendency to come double, though never so completely as the ranunculus-fld. The Rosebud and New Japanese Pompone are selections from the ranunculus-fld. type. "Golden Gate" is a mixture of *P. umbrosum*, *P. lævigatum* and *P. ranunculiflorum* in single and double.

The best of the perennial Poppies are *P. nudicaule* and *orientale*. *P. nudicaule*, the Iceland Poppy, is one of our most desirable perennials. Fig. 1639. If the flowers are cut regularly and no seed-pods allowed to form, it is in bloom from May to October. The fls. are on wiry stalks 12 in. or more long, and well adapted for cutting. The colors are white, yellow, and orange-red; they are easily grown from seed, and will bloom the first year if sown early. It is well to grow new plants every second year, as in the colder parts of the country it is subject to winter-killing when the plants get old.

Very different from the dainty Iceland is the gorgeous Oriental Poppy, one of our most striking and showy garden plants. Fig. 1637. The great fls., 6–8 in. across, deep scarlet with a bluish purple base and stamens, are held well above the foliage on stout leafy stalks. Unfortunately, the flowering season is short: 2 or 3 weeks in June and their glory is gone. They also are easily grown from seed and are very hardy. *P. bracteatum*, deeper in color and more robust, is, strictly speaking, a variety of *P. orientale*. Other varieties have orange, pink, and salmon-colored flowers, but none of them are so effective in the garden border as the type.

P. glaucum, the Tulip Poppy, is a weak, spindly grower if planted thickly. The fls. are of an intense cardinal color, without black blotch; the outer petals much larger than the inner, overlapping at the edges, giving it the appearance of a tulip. *P. arenarium*, in the writer's experience, is scarcely worth growing.

R. B. WHYTE.

INDEX.

aculeatum, 12.
albiflorum, 15.
album, 14, 15.
alpinum, 15.
arenarium, 7.
Atlanticum, 5.
aurantiacum, 14, 15.
bracteatum, 3.
Bride, 1.
Californicum, 9.
cardinale, 1.
Caucasicum, 6.
Chinese, 1.
coccineum, 14.
commutatum, 4.
Corn, 4.
croceum, 14.
Danebrog, 1.
Danish Cross, 1.
Danish Flag, 1.
fimbriatum, 1.
Flag of Truce, 1.
flaviflorum, 15.
flavum, 15.
floribundum, 6.
French, 4.
Gariepinum, 12.
glaucum, 11.
grandiflorum, 2.
Greenlandicum, 14.
Hookeri, 4.
horridum, 12.
hybridum, 2, 3.
immaculatum, 2.
involucratum, 3.
Japanese, 4.
Japonicum, 4.
lævigatum, 8.
luteum, 14, 15.
Mephisto, 1.
Mikado, 1.
Murselli, 1.
nanum, 2.
nudicaule, 14.
Opium, 1.
orientale, 2.
pæoniæflorum, 1.
paeony-flowered, 1.
Parkmanni, 2, 3.
Pavoninum, 16.
Pavonium, 16.
Peacock, 16.
Persicum, 17.
pilosum, 13.
plenum, 2.
præcox, 3.
puniceum, 14.
Pyrenaicum, 15.
ranunculiflorum, 4.
Rhœas, 4.
roseum, 3, 15.
rubro-aurantiacum, 14.
rubrum, 15.
rupifragum, 10, 5.
semiplenum, 2.
setigerum, 1.
Shirley, 4.
Sintenisii, 2.
somniferum, 1.
splendens, 2.
striatum, 14.
sulphureum, 14.
Tulip, 11.
umbrosum, 4.
Victorian Cross, 1.

A. *Capsule not bristly.*
B. *Filaments dilated at apex.*
C. *Foliage glaucous*......... 1. **somniferum**
CC. *Foliage green.*
D. *Fls. not bracted*....... 2. **orientale**
DD. *Fls. with large, leafy bracts*................ 3. **bracteatum**
BB. *Filaments not dilated at apex.*
C. *Stem-lvs. not clasping.*
D. *Herbage decidedly bristly or hairy.*
E. *Stigmatic rays 8–10.* 4. **Rhœas**
EE. *Stigmatic rays 6–8*.. 5. **rupifragum**, var. **Atlanticum**
EEE. *Stigmatic rays 3–6*.. 6. **Caucasicum**
DD. *Herbage sparingly bristly or merely pilose-pubescent.*
E. *Petals purple, spotted dark.*
F. *Lvs. bipinnatisect.* 7. **arenarium**
FF. *Lvs. pinnately parted* .... 8. **lævigatum**
EE. *Petals brick-red, spotted green*...... 9. **Californicum**
EEE. *Petals orange-red, unspotted* ....10. **rupifragum**
CC. *Stem-lvs. clasping*........11. **glaucum**
D. *Herbage bristly*........12. **aculeatum**
DD. *Herbage soft-hairy* ....13. **pilosum**
AA. *Capsule bristly*................
B. *Stems leafless*..............14. **nudicaule**
15. **alpinum**
BB. *Stems leafy.*
C. *Sepals appendaged: capsule minute*............16. **Pavoninum**
CC. *Sepals not appendaged: capsule large*...........17. **Persicum**

1. **somniferum**, Linn. OPIUM POPPY. Fig. 1636. Robust, glaucous and glabrous plant, 3–4 ft. high, with fls. 4–5 in. across, much larger than those of any annual kind. Lvs. oblong, unequally toothed at the base; stem-lvs. cordate at the base: petals orbiculate, every shade from white through pink and red to purple, but not yellow or blue: capsule obovate, stalked, with a flat disk. Greece, Orient. Gn. 9, p. 197. Gt. 40, p. 609; 44, p. 593. R.H. 1893, p. 349. S.H. 2:272.

Among the double forms there are two main strains or types, the carnation-fld. and the pæony-fld. (the latter *P. pæoniæflòrum*, Hort.). The former has fringed petals; the latter not. Both include a wide range of color, and even a yellow form is advertised, but this form is of doubtful authenticity. *P. Múrselli* is another strain of double fringed kinds, of which Mikado is a favorite. *P. fimbriàtum* is another trade name for double fringed varieties. *P. cardinale* is not a botanical name. It is the French name of Cardinal, another strain of double fringed fls. Chinese Poppies are a double-fld. race introduced from Chinese gardens in the early nineties and comprising dwarfer than strains previously known. R.H. 1893, p. 349. An exceptionally interesting monstrosity has occurred in which there are no petals, and the stamens are supposed to be transformed into pistils which actually ripen seed. It was figured as long ago as 1851 in F.S. 6, p. 242 and again in R.H. 1893, p. 349. It seems to be no longer advertised, but it was considered constant.

Among the single varieties, Danebrog is one of the most striking and popular. The white spots at the base of the petals form a cross. This var. is also known as Danish Cross, Danish Flag and Victorian Cross. Of the pure white kinds, Flag of Truce and The Bride are favorites. Mephisto is scarlet, spotted black. About a dozen other varieties are advertised by name.

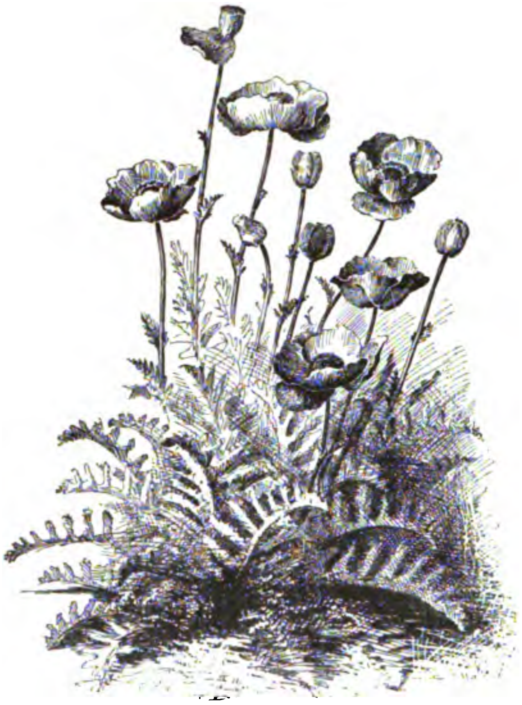
Var. **setigerum** (*P. setigerum*, DC.). *P. setigerum* is no longer advertised, but according to Nicholson numerous fine strains have originated from it. *P. setigerum* is now considered a hairy form of *P. somniferum*. It is a violet-fld. plant native to Corsica and Hyères. It differs in having oblong lvs. which are incised-toothed, the teeth being narrower and more pointed; also the capsule is not stalked, as it sometimes is in *P. somniferum*. S.B.F.G. 172.

2. **orientàle**, Linn. ORIENTAL POPPY. Fig. 1637. This and the next are the most robust and large-fld. Poppies; also the best, commonest and longest lived of the perennials. Plants grow 3–4 ft. high and bear fls. 6 in. or more across. Lvs. hispid, pinnately parted; lobes oblong-lanceolate, serrate: capsule obovate, with a flat disk: stigmatic rays 11–15. In *P. orientale* the petals are originally scarlet with a black spot. It was not until late in the eighties that this species made a decided break in color. A considerable class of hybrids with *P. bracteatum* has arisen which extends the color range through several shades of red to orange, salmon and pale pink. Some are unspotted, some are adapted to cutting, and doubling has made some progress. Among the Latin names of varieties belonging to this class are **grandiflòrum, hỳbridum, immaculàtum, nànum, spléndens, Párkmanni, plènum, semiplènum,** and **Sintenísii.** About a dozen have received common or personal names. Asia Minor. Persia. Gn. 24, p. 459; 42:890. V. 12:33.—T. D. Hatfield makes the following notes: "Oriental Poppies are better divided after blooming, in late July or August. They always grow in the autumn, and these divided plants would start away and make good growth. If divided in spring, they would not recover in time to bloom. Any extra good variety can be increased largely by cutting the roots into short pieces. This also is best done in the summer time."

3. **bracteàtum**, Lindl. (*P. orientàle*, var. *bracteàtum*). Differs from the preceding in having large, leafy bracts. According to Boissier the color of this species in the wild is blood-red and of *P. orientale* scarlet. Also the fls. of *P. bracteatum* are said to be earlier, the lvs. concave instead of flat and the stigmatic rays 16–18 instead of 11–15. Caucasus, Persia. B.R. 8:658. G.C. 1860:647.—A variety with petals more or less united into one was mentioned in 1862–5 in F.S. 15, p. 186, but it seems to be unknown now. Vars. **hỳbridum, Párkmanni, prǽcox** and **ròseum** are advertised. See also species No. 2. *P. involucratum*, var. *maximum*, Haage & Schmidt, seems to be a new and undescribed kind. The name suggests that it may belong here.

4. **Rhœas**, Linn. CORN POPPY. Fig. 1638. Typically a dwarf, green, bristly plant, with pinnately parted foliage and fls. about 2 in. across, two of the petals smaller than the others, all scarlet and spotted black. Height 2 ft. or less. In cultivation every shade known to the Opium Poppy has been reproduced in the Corn Poppy, but the fls. are always smaller. In the wild it varies greatly, the foliage once or twice pinnately

parted, the bristles many or few, appressed or spreading, the fls. spotted or not. Eu., Orient. Gn. 30, p. 297. —Up to 1886 the French Poppies were considered the best strain. Since then the lovely strain known as Shirley Poppies has surpassed all others. This strain was developed by the Rev. W. Wilks, secretary of the Royal Horticultural Society. It is one of the finest contributions to floriculture ever made by an amateur (see p. 1206). Var. **ranunculiflòrum**, Hort., is a strain with double fls. in various colors, self and variegated, with the petals entire, rounded and somewhat reflexed. Var. **Japónicum**, Hort., is a strain introduced about 1893 from Japanese gardens, and said to have smaller and fuller fls. than ordinary and of more varied shades. They are called Japanese or Japanese Pompons. Rhœas was the name used by the ancient Greeks and Romans for the Corn Poppy.



1638. Corn Poppy of Europe. Papaver Rhœas (× ¼).

Var. **umbròsum**, Mottet (*P. umbròsum*, Hort.), is a plant with petals of a darker red than the typical *P. Rhœas* and blackish spots. It was introduced by Vilmorin about 1891, and was considered a marked gain in productiveness. The habit is dwarf, compact, much branched. Soon after a double form was distributed. Mottet considers it a form of *P. Rhœas*, but some botanists consider it a form of *P. commutatum*. Judging from a single trade specimen, the undersigned supposes it is a nearly glabrous form of *P. Rhœas*; the buds are bristly, but otherwise the plant has only a very few appressed hairs on the peduncles and on the lvs. along the midribs. *P. umbrosum* was found growing wild in Attica. *P. commutatum* is a species closely allied to *P. Rhœas*, and differs in having the petals obovate and not overlapping instead of orbicular and overlapping, while the anthers are ovate instead of oblong. R.H. 1891, p. 431; 1893:12; 1893, p. 350. G.C. II. 22:49. V. 9:187.

Var. **Hoòkeri** (*P. Hoòkeri*, Baker). A puzzling plant found in the gardens of India, and of unknown parentage. It is nearest to *P. Rhœas*, and "differs in its great size, for it forms a bushy herb 4 ft. high and upwards, and in the great number of the stigmatic rays, which are 12–20, i. e., nearly double those of *P. Rhœas;* the fls., capsule and seeds also are much larger and the stigma broader in proportion." The fls. attain 3½ in. in diam., and vary from pale rose to bright crimson, with a white or black spot at the base. B.M. 6729. Gn. 29, p. 139. G.C. II. 25:9. Procurable from England.—Said to revert occasionally to *P. Rhœas*.

5. **rupífragum**, var. **Atlánticum**, Ball (*P. Atlánticum*, Haage & Schmidt). Hoary and everywhere covered with copious spreading hairs except the glabrous capsule: height 1–2 ft.: lvs. oblanceolate; hairs spreading: fls. 2–3 in. across; petals orange-red or scarlet; stigmatic rays 6–8: capsule club-shaped. Morocco, 6,000–7,000 ft. B.M. 7107.

6. **Caucásicum**, Bieb. (*P. floribúndum*, Desf.). Biennial, more or less setose: lvs. bipinnately parted or dissected: buds ovate: calyx glabrous or sparsely setose: petals somewhat in pairs: stigmatic rays 3–6. Caucasus. B.M. 1675 (brick-red, not spotted). B.R. 2:134.

7. **arenàrium**, Bieb. Annual, sparingly beset with bristles which are spreading on the stem and appressed on the foliage: lvs. twice pinnatisect into minute linear strips: fls. purple, with a dark spot at the base of each petal; filaments not dilated: capsule obovate or top-shaped, with a convex disk: stigmatic rays 7–9. Sandy places in Caucasus and Caspian region.—Procurable in England.

8. **lævigàtum**, Bieb. Glabrous or with a few small bristles: fls. purple, usually spotted; petals minute, obovate: capsule narrowly top-shaped or club-shaped: stigmatic rays 8–10. Greece, Orient.—It is doubtful whether the plant sold under this name is true, for in G.C. III. 5:21 it is shown with large, roundish, overlapping petals.

9. **Califórnicum**, Gray. Annual, sparsely pilose-pubescent, 1–2½ ft. high: lvs. pinnately parted or divided into acutish toothed or 3-lobed or entire segments: fls. 2 in. across; petals brick-red, with a green spot at the base bordered with rose-red: capsule between club- and top-shaped, flat on top. Santa Inez Mountains and northward in California. Offered in 1891 by Peter Henderson, who described it as "pinkish orange with center of sulphur-yellow." Probably procurable from Calif.

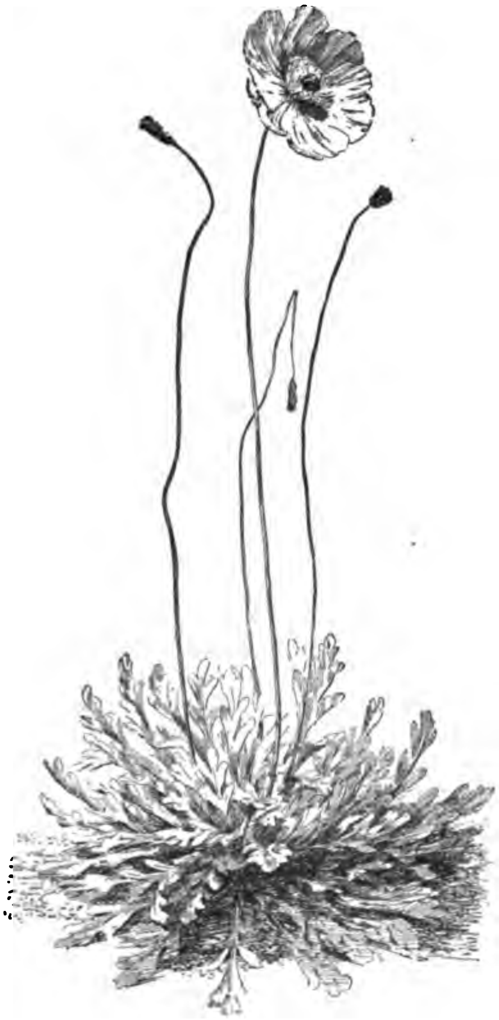
10. **rupífragum**, Boiss. & Reut. Dull green, nearly glabrous. Spain. The typical form offered in England. See No. 5.

11. **glaùcum**, Boiss. & Hausskn. TULIP POPPY. Perennial, glaucous and glabrous except a few small, appressed bristles along the peduncles, branched at the base: stem-lvs. broadly cordate at the base, pinnately lobed or parted; the lobes triangular, dentate; the teeth obtuse, callous, muticous: petals large, scarlet, spotted at the base: capsule ovate, stalked: stigmatic rays about 12. Syria. Gt. 40, p. 608, repeated in G.C. III. 10:527. R.B. 20, p. 58. S.H. 2:467 and V. 15:37. R.H. 1892, p. 463; 1893, p. 350. Int. 1891 by Benary, of Erfurt.—The charming plant sold under this name reminds one immediately of a tulip because of the color and texture of the flower, but especially because of its cup-like shape. The two inner petals are smaller, erect, and make a loose cup. The plants grow about 12–14 in. high and produce 50–60 large fls.

12. **aculeàtum**, Thunb. (*P. Gariepìnum*, Burch. *P. hórridum*, DC.). Annual, 1–4 ft. high: stem branched, densely covered with spreading, rigid, unequal bristles: lvs. green, sinuately pinnatifid, the laciniations spine-tipped: fls. scarcely 2 in. across; petals scarlet-orange, unspotted: capsule glabrous, oblong-obovate. S. Africa, Australia. B.M. 3623.—The only Poppy known to inhabit the southern hemisphere. Procurable in England. Annual in S. Africa, but said to be biennial in northern botanic gardens.

13. **pilòsum**, Sibth. and Sm. Perennial. This flower is about 3 in. across, brick-red, the petals all of a size and with a pale spot at the base: stems tall and scabrous, freely branched: lvs. covered with velvety, appressed hairs; stem-lvs. clasping, broadly oblong, lobed and serrate: capsule glabrous, oblong-club-shaped: stigmatic rays 6–7. Rocky alpine heights of Mt. Olympus in Bithynia. B.M. 4749. Gn. 41, p. 277; 42, p. 585.

14. **nudicaùle,** Linn. ICELAND POPPY. Fig. 1639. Typically a yellow-fld. arctic perennial, more robust than the next, with divisions of the lvs. entire or sparingly cleft, and capsule short, thick and roundish. In America this form is found as far south as southern Colo. on the peaks of the Rockies. Gn. 26:464; 24, p. 342; 28, p. 58; 42, p. 584. V. 13:297. B.M. 1633; 3035 and R.H. 1890:60 (*P. croceum*). F.S. 10:1017 (as var. *croceum*). The following varieties are advertised in the trade: **álbum, aurantìacum, coccíneum, cròceum, striàtum** and **sulphùreum.** Double forms in the various colors are advertised. Older names which are likely to reappear are vars. **lùteum, puníceum,** and **rubro-aurantìacum,** B.M. 2344. *P. cròceum*, Ledeb., a native of the Altai Mts., is a form nearer to *P. nudicaule* than it is to *alpinum*. The name "nudicaule" refers to the lack of lvs. on the stem which distinguishes this and the Alpine Poppy from the common Corn Poppy of Europe. *P. Greenlándicum*, Hort., is possibly a catalogue name for *P. nudicaule*.



1639. Iceland Poppy, Papaver nudicaule (×⅛).

15. **alpìnum,** Linn. ALPINE POPPY. Typically a fragrant white-fld. perennial of the European Alps, of dwarfer habit, with divisions of the lvs. cut into many fine and narrow secondary divisions, and a longer and narrower capsule approaching club shape. Gn. 24:410. L.B.C. 5:434. The following varieties are advertised: **albiflòrum, álbum, aurantìacum, flaviflòrum, flàvum, Pyrenàicum, ròseum** and **rùbrum.** *P. lùteum*, Hort. Ellwanger and Barry, belongs here, but *P. luteum* of the botanists is the Welsh Poppy, *Meconopsis Cambrica*.

16. **Pavonìnum,** Fisch. & Meyer (*P. Pavònium*, Nicholson Dict. Gard.). PEACOCK POPPY. Annual, sparsely hispid-pilose: lvs. pinnately parted, the divisions oblong-linear and incised-toothed: petals scarlet, dark-spotted: capsule minute, ovate: stigmatic rays 4–5. Sandy places of Turkestan and Afghanistan. G.C. II. 26:329.—Botanically it is very distinct by reason of 2 short, horn-like appendages, one on each sepal near the tip on the back. Int. 1886 by W. Thompson, Ipswich, Eng., who added the following points: "dwarf, 1 ft. high, neater and less weedy than most annual Poppies: petals with a gray spot at the base and a horseshoe-shaped band of black. In the early part of the day the flower seems to have a white eye, surrounded by one complete ring of black." A good plant produced 100 flowers.

17. **Pérsicum,** Lindl. Biennial, setose-hispid: stem tall, branching, pyramidate: lvs. pinnately parted: buds oblong: calyx setose: petals overlapping at the margin: capsule large: stigmatic rays 5–6. Persia. B.R. 19:1570 (petals brick-red, with or without a white spot at the base). This has been, and may still be, confused in the trade with *P. Caucasicum*. Both are glaucous, and both advertised in England, but they are biennials.

P. álbum, Hort. Bridgeman, is presumably a double white-fld. variety of the Opium Poppy.—*P. coccíneum*, Hort. Bridgeman, is presumably a double scarlet-fld. variety of the common Poppy.—*P. maculàtum*, var. *superbum*, Haage & Schmidt, is presumably a form of one of the common species. W. M.

PAPAW is *Carica Papaya*; also *Asimina*.

PAPER MULBERRY. See *Broussonetia*.

PAPER PLANT. See *Cyperus Papyrus* and *Papyrus antiquorum*.

PAPHÍNIA (Paphos, city of Cyprus, sacred to Venus). *Orchidàceæ*. A rare and pretty genus of orchids, having the habit of small Lycastes. The curiously shaped fls. are borne on pendent scapes which are mostly 2-fld. Sepals and petals similar, spreading; mentum obsolete: labellum uppermost in the flower. They may be easily grown with Lycastes, and should be planted in fibrous peat and moss. During the growing period they require a liberal supply of water.

cristàta, Lindl. Pseudobulbs ovate, 1–3-lvd.: lvs. lanceolate, 4–6 in. long: scapes pendent, 1–2-fld.: sepals and petals lanceolate, acuminate, spreading, the latter a little smaller; all streaked above and transversely banded below with deep crimson or chocolate-brown markings on a whitish ground; labellum much smaller, chocolate-purple; the 2 lateral lobes oblong, pointed, half spreading, separated from the middle lobe by a deep constriction; middle lobe triangular-rhomboid, with an erect crest and clavate glands on the disk, and bordered in front by a fringe of clavate hairs. June–Aug. Trinidad. B.M. 4836. B.R. 21:1811 (as *Maxillaria cristata*).

rugòsa, Reichb. f. Pseudobulbs small, rounded: lvs. small, linear, acuminate: fls. waxy, creamy white, covered with red spots, which run together in blotches. Colombia.

grandiflòra, Rodrig. (*P. grándis*, Reichb. f.). Fls. chocolate-brown, striated on the lower half of the sepals and petals with greenish yellow and cream color, margins cream: labellum dark purple at the base, with an oblong, cream-colored middle lobe, and a pair of small lobes on each side. Brazil. G.C. III. 14:561.—A curious orchid.

P. Lawrenciana — Lycaste Lawrenciana?

HEINRICH HASSELBRING.

PAPHIOPÈDILUM (Paphinia (above) and word for *sandal*). *Orchidàceæ*. A section of Cypripedium separated by Pfitzer. It is distinguished by the 3-loculed ovary and by the conduplicate arrangement of the lvs. in the bud. Pax writes in Engler & Prantl's Pflanzenfamilien that the "ovary is completely 3-loculed, or 1-loculed below and only the tip divided into 3 locules." The species have not been revised and will be found under Cypripedium and Selenipedium.

P. barbàtum, Pfitz. (Cypripedium barbatum, Lindl.).—*P. Bóxalli*, Pfitz. (Cypripedium Boxalli, Reichb. f.).—*P. caudàtum*, Pfitz. (Selenipedium caudatum, Reichb. f.).

HEINRICH HASSELBRING.

PAPPOOSE ROOT or BLUE COHOSH is *Caulophyllum thalictroides*, a native plant that does not appear to be in the general trade.

PAPÝRUS antiquòrum (Fig. 1640), the Egyptian Paper-plant, is *Cyperus Papyrus*, which see for technical description. It is a tall-growing, graceful aquatic, bearing an umbel of long and slender branchlets. It does not endure frost. It is much used for bedding out about ponds in the summer. The plants for bedding are propagated in January and February, by division of the roots that were brought in from the open in autumn. The plants are kept quiet until the roots are divided. The roots are divided into small pieces, and the divisions are started in a warm sand propagating bed. As the plants grow, they are potted. By late spring the plants should be ready for use in shallow pools in the open.

L. H. B.

1640. Papyrus antiquorum.

PARACHUTE FLOWER, adv. by Blanc, 1900, is *Ceropègia Sàndersoni*, Decaisne, from So. Africa. *Asclepiadàceæ*. It is a tall-twining plant with fls. of most unusual shape and structure. It is figured in B.M. 5792, from which the following extracts are taken: "Stems stout, succulent, as thick as a goose-quill. . . . Lvs. small and distant for the size of the plant, shortly stoutly petioled, 1½-2½ in. long, ovate-cordate, obtuse, thick and succulent, nerveless, deep green like the stems. . . . Corolla 2½ in. long, curved at the base, tube 2 in. broad across the top; tube slightly inflated and green at the base, expanding into a funnel-shaped, 5-angled transparent limb with opaque green reticulated veins; this presents 5 short distant lobes on its margin, which bears the 5 curious horizontal appendages that together form the umbraculiform cap to the flower: this cap is a bright verdigris-green, pitted on the surface and formed of 5 confluent convex lobes with a conical central papilla; each lobe is 2-lobed at its outer margin, and the margins are turned up and bear a series of transparent, flat, erect hairs within the border."

Ceropegia contains about 80 species, mostly African. Several species are known in European collections, but when the first volume of this Cyclopedia was written none had been offered in the American trade. Some of them are bulbous-rooted. They demand a warm or intermediate house, and are propagated by cuttings of the stems. All the species are odd.

L. H. B.

PARADÌSEA (said to be from Paradise, of which this plant is supposed to be a fit inhabitant). Often written *Paradisia*. ST. BRUNO'S LILY. *Liliàceæ*. St. Bruno's Lily and St. Bernard's Lily are advertised in nearly every good-sized catalogue of hardy herbaceous plants, as *Anthericum Liliastrum* and *Anthericum Liliago*, but the former should be called *Paradisea Liliastrum*. Both these plants have white, lily-like fls., borne in early summer on scapes a foot or more high. The fls. of both are tipped green outside. The lvs. are linear, all radical, and a foot or so long. Both plants are natives of middle Europe, and by their popular names recall the life-saving monks of the Alps. It is no wonder, then, that they are often confused. The Paradisea has larger fls., which are funnel-shaped rather than rotate, but the fundamental differences upon which Paradisea is made a separate genus lie in the stamens. In Paradisea (according to Bentham & Hooker), the anthers are attached at the middle of the back and are versatile; in Anthericum the anthers are attached at their base and are erect. Moreover, the stamens of Paradisea are hypogynous; of Anthericum, perigynous. Following are some of the other differences as given by Baker in Journ. Linn. Soc. 15:286, 287, 301 (1877):

Paradisea Liliàstrum, Bertol., has 6-8 lvs.: scape 12-24 in. high: raceme 2-10-fld.: bracts lanceolate: perianth 18-21 lines long: style 15-18 lines long; ovary and capsule oblong.

Anthericum Liliàgo, Linn., has 12-20 lvs.: scape 6-15 in. high: raceme (sometimes panicled) 10-20-fld.: bracts linear: perianth 6-9 lines long: style 5-6 lines long: ovary and capsule globose. Some of the above characters will not hold for cultivated plants.

P. Liliastrum, var. *major*, Hort., is said to be a much larger and better form than the type, growing 2-3 ft. high and bearing more and larger fls. Gn. 9:1 (as *Anthericum Liliastrum* var.) has fls. 2 in. long and 2½ in. across.

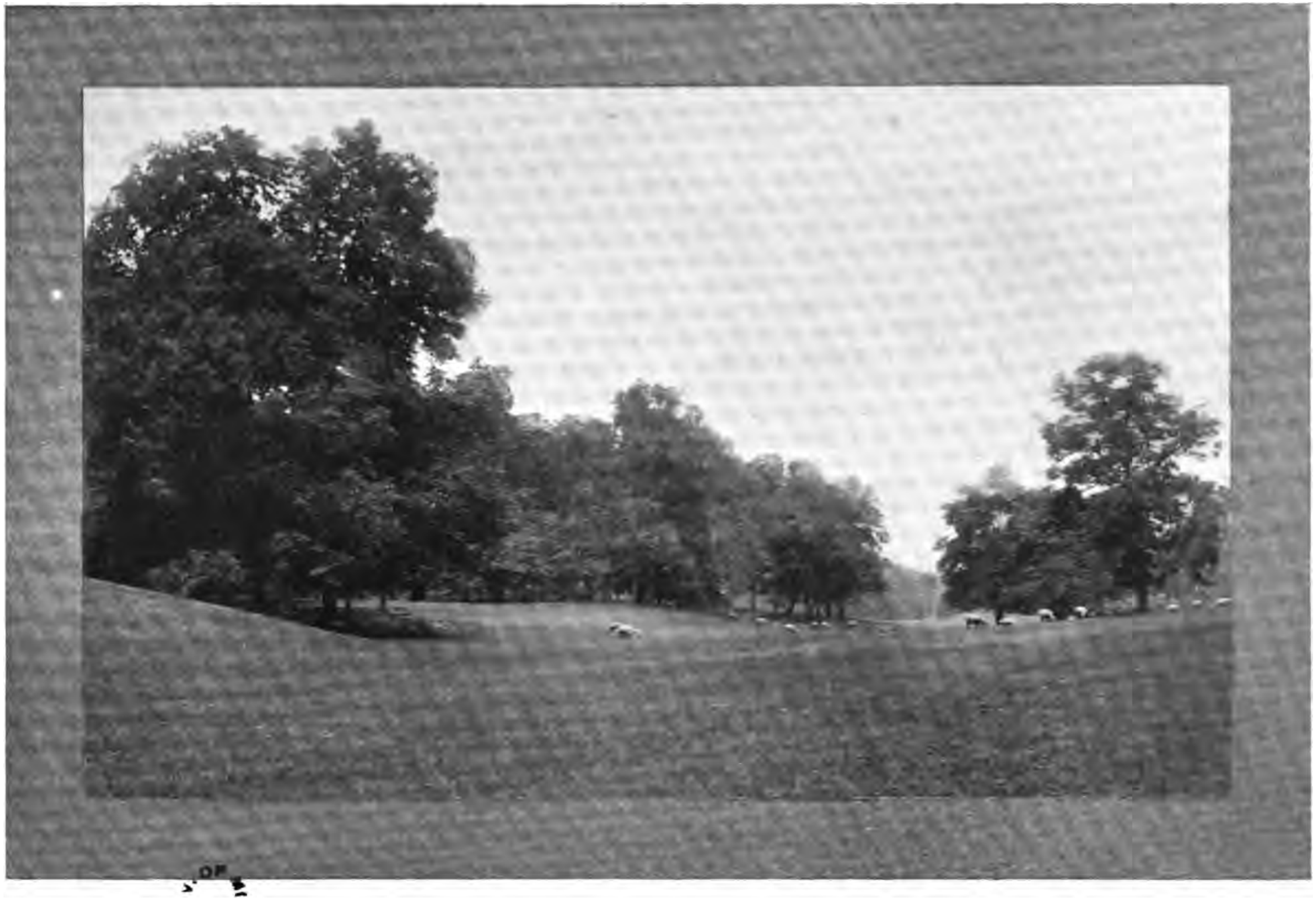
W. M.

PARADISE FLOWER. *Strelitzia reginæ.*

PARAGUAY TEA. *Ilex Paraguariensis*, not in the Amer. trade.

PARA NUT. *Bertholletia.*

PARASITE. A parasitic plant is one which fastens itself upon another plant (or other organism), and, stimulated by the latter, either grows into its interior, or sends certain sucking organs into its tissues by means of which a part or all the nourishment necessary for the Parasite is obtained. A plant which lives upon dead organic substance is termed a saprophyte (which see). The most common Parasites are to be found among the fungi, which are the abundant causes of plant diseases,—such as rusts, smuts, and mildews. These fungous Parasites secure all of their nourishment from the host, or plant attacked, and most commonly grow within the tissues until ready to form their reproductive bodies, or spores. There are also Parasites among flowering plants. Of these there are two principal classes: (1) those green in color, or chlorophyll-containing, such as the mistletoe and the bastard toad-flax; and (2) those practically devoid of chlorophyll, such as the dodder



UNIV. OF MICH

Plate XXV. Example of the large rural Park.—View in Prospect Park, Brooklyn.

and the broom-rape. Members of the first class are active photosynthetically, and may manufacture their own carbonaceous material from CO_2 and water, while members of the second class must receive all or nearly all similar foods from the host. There are all gradations between Parasites and saprophytes; there are plants parasitic at one stage and saprophytic at another, and there are those which are at once parasitic and saprophytic.
B. M. Duggar.

PARASOL, CHINESE. *Sterculia platanifolia.*

PARASOL FIR or TREE. *Sciadopitys verticillata.*

PARASOL PINE. *Pinus Pinea.*

PARDÁNTHUS. See *Belemcanda.*

PÁRIS (name discussed below). Herb Paris. Love Apple. *Liliàceæ.* Everyone who knows and loves a Trillium will be interested in the Herb Paris, which differs from a Trillium in having its floral parts in 4's instead of 3's. There are about 8 species altogether, and in some of them the floral parts are in higher numbers than four. They resemble Trilliums in being small, hardy, rhizomatous plants, found in mountainous countries of the north temperate zone, and even in the arctic regions. Also they have a single whorl of lvs. at the top of the scape and a single flower, but in Paris the outer perianth segments are more herbaceous and calyx-like, while the inner ones are much narrower and less showy, being mere strips of petal or even entirely absent.

The name Paris is an interesting one. The berry of the plant is compared to the apple of discord, while the four leaves surrounding it are likened to Paris and the three envious goddesses, Juno, Minerva and Venus. Others think the name is derived from *par*, equal, referring to the agreement in number between leaves and floral parts.

quadrifòlia, Linn. Herb Paris. True Love. Height 9–12 in.: lvs. netted-veined (very exceptional among monocotyledons): peduncle rising 1–2 in. above lvs.: perianth segments yellowish green, the 4 inner ones rather more yellow: berry bluish black. Rarely the lvs. and floral parts are in 5's. The dominant European type, scattered all over Eu. and Siberia from the Arctic circle to the Mediterranean, in woods and shady places, but usually very local. Fls. in spring or early summer. Gn. 31, p. 165.—Not advertised in America at present.
W. M.

PARIS DAISY. *Chrysanthemum frutescens.*

PARÍTIUM tiliàceum is referred to Hibiscus in this work. It is a handsome shrub or small tree, of 10 to 30 feet, bearing considerable general resemblance to the cotton plant, for which travelers have sometimes mistaken it. In Porto Rico it is often planted for hedges along roadsides, and is very abundant in waste places near the sea. It was already widely distributed in America in prehistoric times, and has now been introduced throughout the tropics.

It is valued for its very strong bast fiber, which has much similarity to jute, but differs in the peculiar property of maintaining or even increasing its strength after long maceration in water. The extraction of the fiber for the manufacture of cordage and other purposes, offers no special difficulties. It has also been recommended for paper-making. At present it is utilized in Porto Rico for domestic purposes only, all the home-made ropes being twisted from it. The conditions are, however, very favorable for the cultivation of *emajagua* on a large scale, should more extensive industrial uses be found for it.
O. F. Cook.

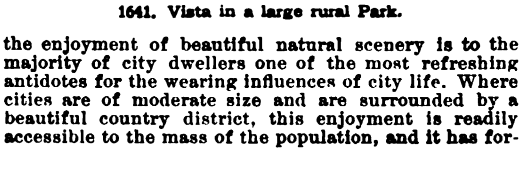
PARK. Plate XXV. A tract of considerable size set apart primarily for enjoyment. Meaning originally, in England, a place for the preservation of deer for the chase, the word is often used now to denote the landscape character commonly associated with such deer parks. In the United States, when the original signification is meant, the word is modified, as deer park, game park, etc. As a type of landscape the park is characterized by comparatively broad stretches of pasture lying between irregularly and rather widely spaced masses of tree foliage. It is extremely simple and quiet in character, and while it often contains many other elements, such as ponds or running water, thickets of bushes under the trees or occasionally outstanding, houses, bridges or other artificial structures, these features are all subordinate as well as harmonious if the scene can be called typically park-like.

Private Parks attached to country houses, in America, are usually so called because they have, or are intended to have, something of this park-like type of scenery. A place departing very widely from this type is called, according to its character, a wood or grove, a garden, a farm, or more vaguely by the general term country-place.

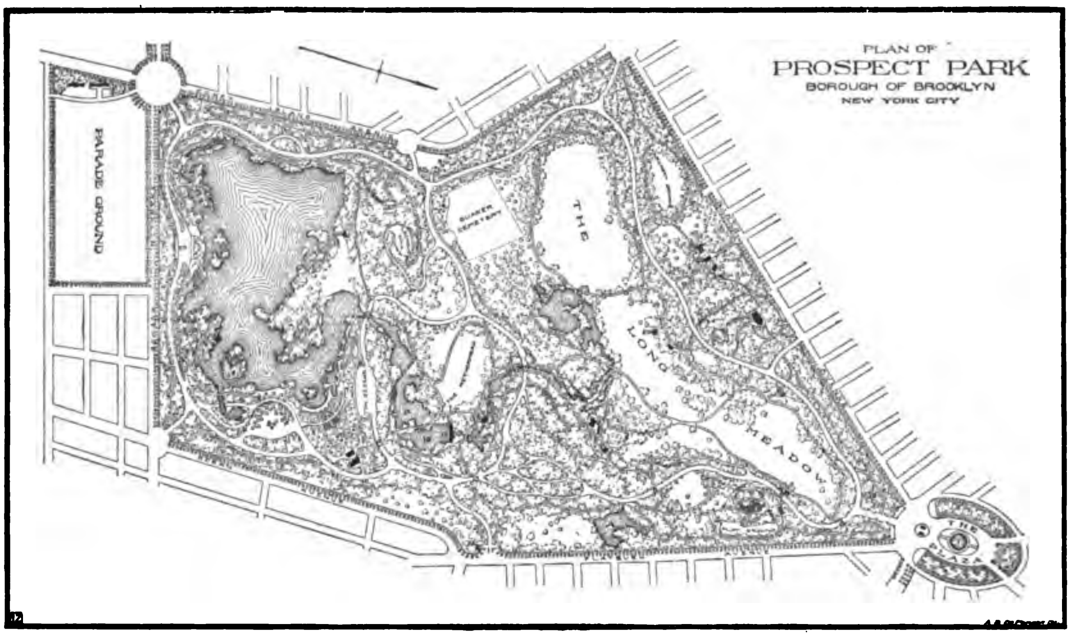
Public Parks are so called, not because their scenery is necessarily of the type properly associated with the word "park," but because converted Royal Parks were the most notable public pleasure grounds of English cities at the time when they began to feel the need of making municipal provision for the outdoor recreation of their growing populations. The earliest important pleasure grounds of municipal construction were based upon these and upon private parks as models, and the name "park" came to be so attached to municipal undertakings in the way of outdoor recreation, that it is now almost indiscriminately applied to any tract of land set apart for public enjoyment, regardless of the kind of enjoyment or the character of its scenery; but the best usage appears to confine the meaning of public park to a tract of considerable size, leaving the lesser spaces to be called squares, gardens, playgrounds, places, etc. Another special use of the word in America is its application to tracts of land in the West, many square miles in extent, either set apart by government, as Yellowstone Park, or naturally distinguished by the presence of comparatively gentle grazing land in the midst of rougher country. "Park" is also used in a more general way to indicate the general purpose of any open land devoted to public recreation, or of the organization controlling it, etc., as "park system," "park department," etc.

A large city park system usually contains parks of varying size and character and many smaller pleasure grounds. No rigid classification can be made, but the following may be regarded as reasonably distinct types, each having its own field of usefulness, its own merits and its own limitations. In practice the lines between these types cannot be distinctly drawn, but poor results are often due to losing sight of the distinct and often conflicting motives which have given rise to these types.

1. *The large rural Park* (Plate XXV. Figs. 1641–3), generally from 200 to 1,000 acres, is in most cases the chief feature of a city park system. It is seldom undertaken except by large cities or cities so rapidly growing that the need of such provision can be clearly foreseen. Its main object is to provide conveniently in some degree for the inhabitants of large cities that sort of recreation which is to be obtained by strolling or driving in a pleasant country district. There is no doubt that the enjoyment of beautiful natural scenery is to the majority of city dwellers one of the most refreshing antidotes for the wearing influences of city life. Where cities are of moderate size and are surrounded by a beautiful country district, this enjoyment is readily accessible to the mass of the population, and it has for-



1641. Vista in a large rural Park.

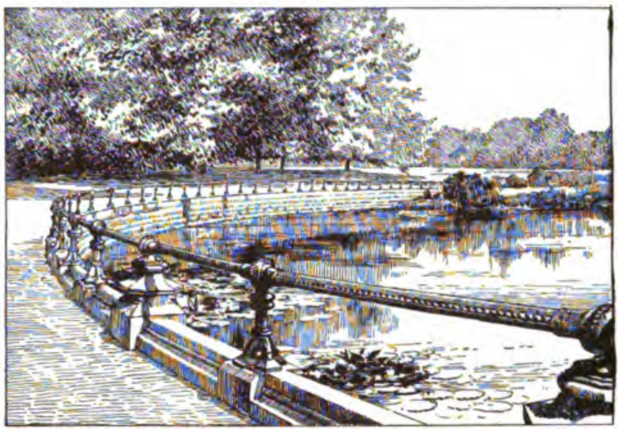


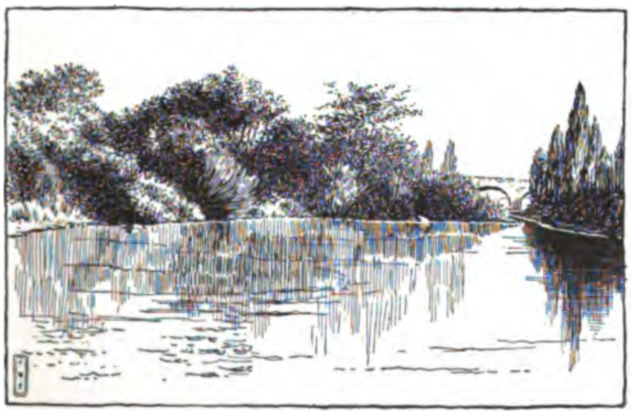
1642. Plan of Prospect Park, Brooklyn, to illustrate the large rural park.

tunately become more so in proportion to the size of the cities within the last fifteen years through the development of trolley car lines and the use of the bicycle; but this increased accessibility of the country has been in part offset by the growth of the cities during the same period, and by the serious impairment of the rural quiet of the suburban regions through the same cause—improved cheap transportation. It is therefore necessary, if the people of large cities are to have easy access to refreshing rural scenery, that the municipality should withdraw from its taxable area a tract sufficiently large to provide such scenery within its own limits. The cost, both directly in money and indirectly through interference with the street system and with the normal commercial development of the land, is necessarily very great, and only the purpose of providing beautiful scenery, thoroughly contrasting with the city life and measurably sequestered from all its sights and sounds, can justify this cost, because almost all the other purposes served in public recreation grounds can be met more economically and far more conveniently in smaller areas distributed throughout the city. The essential characteristics of a well-designed and well-managed park of this class are, therefore, that all of the numerous other objects which it may serve are subordinated to the provision of beautiful scenery and to rendering this scenery accessible and enjoyable by large numbers of people, and that the subordinate objects are met only in such ways and to such a degree as will not interfere with the simplicity and the rural and natural quality of the scenery.

Although Central Park, in New York, is the most noted park of this class in America, it can hardly be taken as the most typical example on account of its rocky, complicated topography, its unfortunately narrow shape, owing to which the surrounding high buildings to a great extent dominate its scenery, and to the interruption offered by the great reservoirs which cut it into two independent parts. Prospect Park, in Brooklyn, begun in 1866, is here described in some detail for the purpose of affording a concrete example of the principles that the writer wishes to illustrate respecting rural parks. Fig. 1642 and Plate XXV.

Prospect Park has an area of 526⅙ acres. Its main entrance is about 3½ miles from New York City Hall, or 1¾ miles from Brooklyn City Hall. It is approached from the city by four lines of trolley cars, but is at the city end of the Parkway System, so that it must be reached through ordinary streets. The chief features of its design are: 1st, the open, park-like landscape of the Long Meadow; 2d, the woodland section, hilly and rising to an elevated outlook; 3d, the lake and its surroundings; 4th, a series of minor passages of scenery and elements of interest fitted in at points not appropriated for the main effects. The most characteristic and most valuable part of the park is the Long Meadow with its surrounding masses of wood, from the shade of which the outlook ranges over one of the most beautiful and simple park landscapes in the country. But one is not brought directly to the Meadow from the outside streets. One goes at first through a formal plaza, then through a retired, shady ante-chamber, just long enough to give a sense of retirement from the city, then, if on foot, through an archway under the drive, that does away with the nervousness of crossing a throng of carriages, and then one comes out suddenly upon the joyous, sunny greensward. Its extent—over 50 acres—is enough to secure an effect of breadth and enlarged freedom without bringing its whole expanse into a single view. One can see that it reaches beyond the projecting groves and scattered trees that form the background of the main composition, and he is tempted to stroll on and open up the prospects thus suggested. The surrounding groves are freely used for picnic parties, and although much of the ground is tramped bare beneath the trees, but little serious harm is done. A carrousel or merry-go-round with its loud, mechanical organ, the only discordant feature of the place, was removed to this point a few years ago. This piece of apparatus was originally designed to be in a retired section devoted to children's games, where all sorts of amusing apparatus might be placed without intruding on the park at large. The children's playground, not being shady or attractive for its purpose, has now been transformed into a rose garden. On the lower edge of the Long Meadow are the pools which are at the source of the park ornamental water system. They illustrate both the value of water in a park landscape and the practical difficulty of securing and maintaining agreeable natural shores within the confines of a large city. Where the banks are clothed with shrubs the effect is admirable, but wherever the grass-land comes to the water's edge and in many places where shrubs once grew, the ground has become foot-worn to utter bareness. Little iron railings in parks are in themselves no protection in great public resorts, and even wire fences may entirely fail to prevent people from trampling some of the shady banks and rockeries into barrenness. Adequate policing and prompt repair of points that cannot withstand too free use is the only remedy, and these should never be lacking in all city parks. Leaving the Meadow, the water flows down through a ravine in the woodland portion of the park, wholly overshadowed by trees with a varied undergrowth. Through this woodland section the paths and drives are comparatively narrow, numerous and intricate, as befits the intricacy and detail of sylvan scenery, and points of special interest are marked by simple rustic seats, shelters, outlooks, and the like. In the southern part of the park is a lake 62 acres in extent, of artificial formation, but of natural appearance. It is large enough to afford good boating in summer and skating in winter for large numbers, as well as providing innumerable broad and beautiful water views. Electric launches carry passengers around a 2¼-mile circuit for ten cents. The shores of the lake are for the most part wooded with tree plantations, now well grown, and are very attractive except where indiscriminate use has worn them bare or where the originally intended wild undergrowth is lacking. Parts of the shore have for contrast the open meadow character, a character which will be emphasized when some of the planted trees are cut, as necessary. Several important points were chosen in the design of the park as places for the gathering of large and dense crowds, and were planned with that end in view. The first of these was the concert grove near the east end of the lake. The great breadth of bare ground or pavement wherever large crowds gather frequently, makes absurd any attempt to simulate natural scenery in such a place, and in the design of the concert place a grove of formally planted trees with architectural accessories was made upon gently rising ground, arranged radially at one side of a little bay in the lake, upon an island in which the band-stand was to be placed. Upon another side of the bay a large concourse for carriages was also provided, and in connection with the formal treatment of the concert grove was built a shelter, a restaurant and a terrace overlooking the main drive. While the grove was still so young as to be unattractive a band-stand was erected in a natural grove near the Nethermead, a place in which the intricate woodland scenery with its brook and pools and shrubbery, and the correspondingly intricate arrangements of narrow paths and bridges, bridle path and drive, were unfitted for accommodating a large crowd. Here the people are now drawn in thousands, wheelmen, carriages, horses and people on foot, all trampling about together among the trees and where the grass and bushes once grew, and blocking the narrow bridges. The unused concert place now has a display of bedding plants. The second gathering place was at the top of Lookout Hill, which rises 100 feet above the surrounding country and commands a noble view extending out to sea. Here is a large carriage concourse, although a shelter and other provisions designed for those on foot are not provided. The plantations upon the flanks of the hill have now become so high and so continuous that the views are nearly closed. A third point, the Breeze Hill Concourse, which originally enjoyed a good view of the lake as well as a good breeze, has now grown up so that it is no longer attractive as a view-point and has been converted into a plantation for perennials, as a Colonial Garden. Of the other subordinated features of interest may be mentioned the Deer Paddock, the Wild Fowl Pond, the Vale of Cashmere, the Archery Grounds and the Greenhouses. The space set apart on the plan for a Deer Paddock is a detached open area of suitable park-like kind; this land is now used as a nursery ground, and the deer have been introduced on steep and broken ground in the midst of the woodland section. The Wild Fowl Pond is in such a situation that there is little temptation to go down and injure its steep banks by walking along them, and the effects of the views from path, road and shelter across its surface to the picturesque foliage of its opposite margin are admirable, especially when it is enlivened by moving birds. The Vale of Cashmere is a narrow valley containing a little winding pool and filled with a rich and varied massing of rhododendrons and other flowering shrubs and evergreens, growing in an irregular and picturesque manner. However a visitor may be impressed by any of these special features with their strong, individual characters, he need see none of them that he does not particularly care for, as they are all self-contained and do not obtrude themselves upon the dominant park landscape, for the sole object of securing which the limits of the park were extended to their present size. The above remarks illustrate the type of changes that are likely to occur in all public parks, and for this reason they may be suggestive to the reader.


1644. Edge of the concert grove in Prospect Park.


1643. Water scene in a large rural Park.

2. *The small city park* (Fig. 1644–5), from ten to two hundred acres or thereabouts, is usually an effort in the same general direction as the large rural park, with a limitation fixed by the difficulty of setting apart a large body of land in one piece at a point of access to a large population. It is almost impossible to attain within so small a space the degree of seclusion from the city and the sense of breadth, simplicity and freedom that are the essential features of the

landscape of a rural park; yet small passages of interesting and agreeable scenery are often attainable, and the obviously artificial objects which may intrude upon them can often be so treated as to harmonize with the effect. The scenery can seldom be quite natural in appearance, but it can often be very beautiful, a certain elaboration, elegance and even magnificence taking the place of the more quiet and restful simplicity of the large park, in a way that appeals very obviously to many people, and there is therefore more or less tendency to develop large parks in the same direction. It is unfortunate that it should be so, for as these ends can be attained almost as well upon small parks as upon large, it is clearly a mistake to treat one large park in this style instead of several of smaller size so distributed as to serve conveniently a larger population. It is because more cities have small parks of this elaborate and what might almost be called gardenesque treatment than have large and simple rural parks, that so many people have a perverted conception of what constitutes a park.

Morningside Park, New York (Fig. 1645), is an example of a small city park upon an extremely rugged and picturesque site, planned, in order to enhance this quality, with an avoidance of decorative elaboration. It occupies a craggy hillside strip from 200 to 500 feet wide and ⅔ of a mile long, with a difference of elevation of from 50 to 100 feet between one side and the other, rendering the land unfit for streets or buildings. From its situation as well as its narrow shape it is essentially unsecluded; indeed one of its most notable features is the impressive and utterly unrural view which it offers over the busy streets and houses of Harlem, that stretch away from its base. This view and the boldness of the crags is emphasized by a stone terrace along the upper edge, supporting a promenade and a tree-lined boundary street. Convenience of passage is met by numerous broad paths, with masonry steps fitted to the irregularities of the ledges. The planting among the ledges was designed to be of the tangled sort such as often clothes broken ledges naturally, while the more level land at the base of the crags is treated by contrast as a smooth lawn, with scattered trees. The natural boldness of the crags is partly lost by an effort to extend turf over every possible area, and the shrub planting is possibly rather too garden-like in style to be in entire accord with the situation, but in general the park is treated in a manner approaching that of the large parks, although without any attempt at complete rural seclusion. It contains a little over thirty acres, exclusive of the various boundary streets and promenades.

More commonly small parks are used for the display of interesting and showy flowering shrubs and trees, and make a feature of fountains, statues and other sculpture more or less good. In moderation and skilfully used such objects, together with terraces and other architectural work, are entirely appropriate and desirable in parks of this class, and add much to the effect of elegance and richness. The predominant purpose is to please the eye, as in the large parks, but in a way that has often a little of the element of spectacular effect and certainly more of interest in the individual objects than in the case of the quiet rural park. The enjoyment is more closely related to that offered by architecture and decorative design and other pleasures forming a part of the daily city life.

3. *Neighborhood pleasure grounds* are spaces of varying size coming within the scope of the park system, and including numerous aims other than the enjoyment of scenery. Sometimes the leading feature is a playground for athletic sports, sometimes a sort of outdoor kindergarten for little children, sometimes a concert grove and promenade, sometimes a menagerie, sometimes a public bathing place or boating place. The area is usually restricted, and, as the name indicates, the object is to offer the maximum of outdoor recreation for the people of a single neighborhood, when they have not the time to go far afield. As children out of school hours are most in need of such provision, playgrounds form an important feature in many grounds of this class; but in all the best examples the means of meeting the various practical requirements, whether athletics, band concerts or what not, are so arranged as to produce a pleasing effect on the eye as well. This is the more difficult from the fact that these grounds get very hard usage: and it is practically impossible to maintain a respectable turf on the area devoted to a playground. This is sometimes left in loam worn bare in streaks and patches by the playing, but it is better surfaced with well-compacted gravel. So far as any single example can represent this class, which must vary in every element with local conditions, Charlesbank, in Boston, may be taken as an illustration. This playground occupies a tract of about ten acres upon the borders of the Charles river at a point near a district of considerable congestion, and occupied by a population of a poor class. A promenade was established on the edge of the sea wall about two thousand feet in length, and between it and the undisturbed streets a playground was laid out, having an average width of about two hundred and fifty feet. Within this long, narrow belt of public ground were established two outdoor gymnasia, each with a running track and a building for dressing and bathing. One of these outdoor gymnasia was designed for women and children and the other for men and boys, and they are at the opposite extremities of the playground. The tract between them was laid out with walks, trees, shrubs and turf, and was intended primarily to appeal to the æsthetic senses. The Charlesbank has well proved the practicability of maintaining, within the very heart of the city, a tract of ground occupied by greensward and trees despite the fact that it is frequented by thousands of men, women and children. The city of Boston provides free instruction in gymnastics upon the playground, and yearly over 70,000 women and girls, and 200,000 men and boys have made use of the facilities offered. The total cost of this playground for land and improvements to date is $382,000, and the yearly cost of maintenance is $10,000.

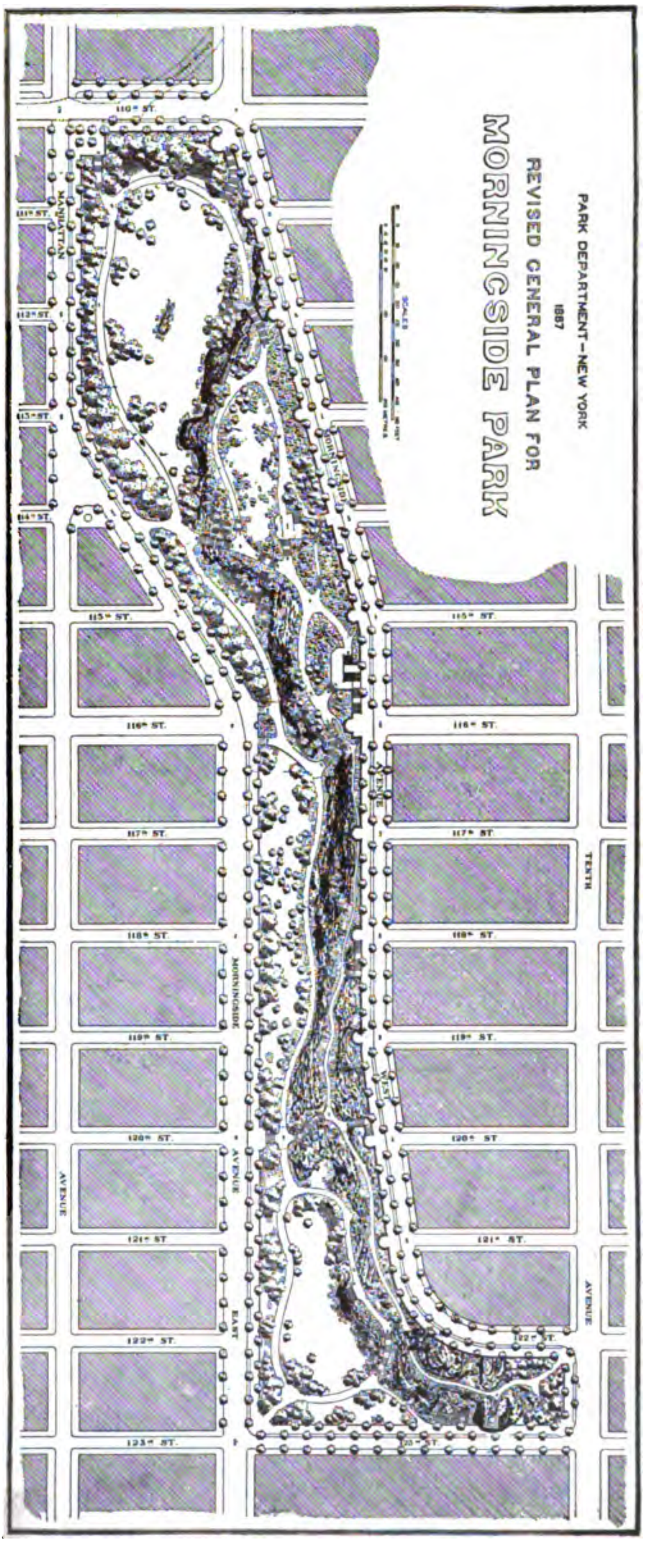
4. *Squares, places, gardens*, and the like, usually of small area, are scattered about a city at street intersections and the like. Their principal functions are to furnish agreeable sights for those passing by them or through them in the course of their daily business, and to provide a pleasant resting place or promenade for the much smaller number who take the time to use them so. On account of the almost constant passing through such squares the best arrangements all provide for reasonably direct and convenient paths along the lines most used. Where this is not done many of those who use the square are likely to be so irritated by the indirectness as to miss much of the pleasure they might otherwise receive. A formal plan of walks, either on straight lines or curved, is generally adopted for such squares, and is well suited to the conditions and to the decorative treatment of the area, providing much more effectively than an irregular plan for the numerous statues, fountains and gay flower beds which have their most appropriate location in such a place. Shade trees, either as a complete grove, or in rows along the paths, or grouped in some more complex plan, are almost essential features of such squares, but where displays of flowers are to be made open spaces must be left for sunlight. A modification of this type of square is sometimes met with where the space, instead of being used as a short cut and for enjoyment from within, is designed primarily to present an agreeable picture to those passing it upon the adjacent streets. When the area is very small and the passing is almost wholly along one side, and in other special cases, this treatment is most effective, because, where the only aim is a beautiful pictorial effect from a limited point of view, better results can be obtained than when appearances must be reconciled with other uses of the land. Nevertheless there are few cases in which a small square will not have a greater recreative value to the public if its pictorial aspect is somewhat sacrificed to such uses as resting and promenading.

5. *Parkways and boulevards* as parts of a park system serve usually as pleasant means of access to parks from other parts of the city, or from one park to another, and also as agreeable promenades in themselves. Commercial traffic is usually excluded from them. Boulevards are arranged formally, usually upon straight lines, with rows of shade trees and parallel

ways for those on foot and on wheels. The simplest type has a broad drive in the center with a walk on either side separated from the drive by a belt of turf and it is always shaded by trees. Frequently, two driveways are provided with a broad space between containing trees and turf, and sometimes foot paths, bicycle paths, bridle paths or other conveniences, and often shrubs, flowers, statues and other decorations. A further development is arranged like the first form, with the addition of narrow streets for house frontage on each side and with an enlargement and elaboration of the planting spaces between the middle and side drives. Of recent years some boulevards have been made to provide for electric car tracks upon a special turfed reservation with rows of trees, where the cars can attain high speed with little danger of collision with other vehicles. Such reservations are generally between two roadways, but in some suburban districts, notably in the city of Rochester, a single-track reservation is placed on either side of a single roadway between the curb and the sidewalk. A parkway, so far as it can be discriminated from a boulevard, includes more breadth of turf or planted ground and includes, usually, narrow passages of natural scenery of varying width, giving it a somewhat park-like character and inducing a less formal treatment of the roads, paths and accessory features. Parkways are frequently laid out along streams so as to include the natural beauties of brook or river scenery and to preserve the main surface-water channels in public control, thus providing for the adequate, economical and agreeable regulation of storm drainage and floods.

6. ***Outlying reservations*** of almost undeveloped country scenery, usually from 500 to 5,000 acres in extent, are wisely included in the park systems of some of the larger cities on account of the increasing difficulty of reaching the unspoiled scenery of the open country, and because, otherwise, the increasing numbers of people seeking such scenery upon the outskirts of the suburbs secure their pleasure at a constantly increasing discomfort to themselves and to the private landowners upon whose property they are forced to trespass. The most notable of such reservations in America are those of the Boston Metropolitan District, comprising four forest reservations with a total area of a little over 10,000 acres, with 17 miles of connecting parkways. The most notable of such reservations in Europe are those of London, especially Epping Forest (5,346 acres) and Richmond Park (2,358 acres); and those of Paris, amounting to about 20,000 acres, chiefly maintained, not by the city, but by the national government.

Management.—The most generally adopted and most successful method of managing city parks in the United States is by an unpaid commission of three to five members appointed for terms of three or five years and retiring successively, so as to maintain continuity of policy and comparative independence of local political changes. The commission appoints as executive officers a secretary and a superintendent, the latter having some technical skill, and each devoting his whole time to the work and receiving a salary. Under the orders of the superintendent, who receives his instructions



1645. Plan of Morningside Park, in the upper part of New York City, to illustrate the small City Park.

direct from the board, are employed an engineer, local superintendents, gardeners, foremen, etc. The engineer is generally an assistant of the city engineer, assigned temporarily to park work. When new parks are to be acquired or plans are to be made for their development, a professional landscape architect is employed to advise the board and to make plans, and is usually retained at least in a consulting capacity during the period of construction. Some large cities retain a consulting landscape architect permanently to advise them with regard to questions of improvement and maintenance affecting the design of the parks.

1646. A park-like effect in a private garden.

Statistics.—Reliable statistics of parks are almost unattainable. The accompanying incomplete compilation (see foot of page) was made in 1897 by the secretary of the Louisville Park Commission. Some items are corrected to 1900.

Bibliography.—"Park" in American Cyclopedia, Encyclopedia Americana, Johnson's Cyclopedia; Park Reports of the various cities, especially New York, 1857–1868, special report accompanying plan of Central Park, 1858; Brooklyn, 1867–1873, special report accompanying plan of Prospect Park, 1866; Boston, 1879, 1880, 1885, city document 125 of 1880; Boston, Metropolitan District, 1893; Buffalo, 1871, 1886, 1888; Chicago, report on plan of South Park, 1871; Montreal, report on Mount Royal, with plan, 1881. See Proceedings American Social Science Association, 1870, 1880; "Mass. Park Law," state printers, 1894; Proc. Amer. Park and Outdoor Arts Assoc.

F. L. Olmsted, Jr.

PARKINSÒNIA (John Parkinson, 1567–1629, London apothecary, author of the delightful Paradisus Terrestris and Theatrum Botanicum). *Leguminòsæ.* Seven or 8 species of tropical trees or shrubs, often armed with short spines: lvs. bipinnate, with 1 or 2 pairs of pinnæ; the common petiole short, often obsolete or spinescent; stipules minute or none: fls. yellow or whitish, on slender pedicels in short, loose axillary or terminal racemes; calyx 5-parted, produced at base and jointed upon the pedicel; petals 5, clawed, the upper one within and broader than the rest, somewhat cordate, the claw pubescent and nectariferous on the inner side; stamens 10, free, the upper one gibbous outside: ovary several-ovuled, shortly stipitate: pod compressed, 2-valved, linear to linear-oblong, more or less twisted: seeds compressed, albuminous. Bot. Calif. 1:161.

The dominant type, both in the wild and in cult., is *P. aculeata*, the Jerusalem Thorn, which is probably a native of America, but is naturalized or cult. in all tropical countries. Another species is S. African, 3 are S. American, and the rest belong to the region between Texas and S. Calif. *P. aculeata* is a thorny evergreen tree with feathery drooping branches and handsome yellow fls.; it is admirable for hedges, thrives in the driest places and can endure some cold. It has been cult. in European conservatories, being usually raised from imported seeds, but it is of difficult culture. *P. Torreyana*, though generally destitute of lvs., is known in northern

Name of City.	*No. large parks.*	*Acreage.*	*Other spaces.*	*Acreage.*	*Total Acreage.*	*Total appropriation and cost*	*Population.*	*Cost per capita.*	*No. inhabitants per acre.*
Albany, N. Y.	3	280	8	15	295	$2,135,700	100,000	$21 35	339
Baltimore, Md.	9	1,100	20	87	1,137	10,000,000	600,000	16 66	527
§Boston, Mass., proper	9	1,894	28	465.57	2,359.57	16,627,033	530,000	31 37	224
§Boston Metropolitan—Reservations.	13	9,279 46				9,545,528 †			
Parkways	7	17.1M							
§Buffalo	6	955	20	70.5	1,025.5	4,971,769	350,000	11 43	369
Cambridge, Mass	1	137	2	21	158	1,021,500	81,650	12 51	516
Chicago, Ill.	9	2,097	23	497	2,594	29,561,660	1,800,000	16 42	694
Cincinnati, Ohio	6	400			400	2,000,000	300,000	6 66	750
Cleveland, Ohio	8	1,178	8	36	1,214	2,000,000	350,000	5 71	288
Des Moines, Iowa	4	400	3	5	405	116,000	75,000	1 55	185
Denver, Colo	9	520	2	20	5 0	387,608	150,000	2 58	278
Duluth, Minn.	4	400	10	25	425	550,000	67,000	8 20	158
§Essex County, N. J.	3	969.7	3	83.43	1,053.13	1,500,000			
Hartford, Conn.	6	1,060	9	7	1,067		70,000		65
Indianapolis, Ind	1	89	2	27	116	290,000 *	183,000	1 58	1,578
Kansas City, Mo.	3	1,338			1,338	100,000 **	160,000	0 63	119
Louisville, Ky.	3	1,055	4	10	1,113	1,003,520	215,500	4 66	194
Parkway			1	48					
Milwaukee, Wis	7	400	9	61	461	1,140,000	300,000	3 80	651
Minneapolis, Minn.	11	1,500	25	40	1,540	2,750,000	200,000	13 75	130
Boulevards	9								
New York City Park System					5,190	50,000,000	2,000,000	25 00	385
Borough of Brooklyn	2	1,052	29	523	1,575	30,000,000	1,300,000	23 07	825
Omaha, Neb.	6	550	3	2	552	750,000	140,000	5 35	254
Peoria, Ill	4	322	3	12	334	350,000	60,000	5 83	180
Pittsburgh, Pa.	1	767			767	3,000,000	290,000	10 35	378
Philadelphia, Pa.	1	3,300	22	318	3,618	6,250,000	1,250,000	5 00	345
Richmond, Va	4	354	9	31	385	132,000	100,000		267
St. Louis, Mo.	10	2,134	10	43	2,177	5,100,000	638,000		
St. Paul, Minn.	2	802	44	87	889	296,415 ***	133,200		174
San Francisco, Cal	3	1,090	14	224	1,314	3,744,605	360,000	10 40	274
Springfield, Mass	1	1,463	24	20	483	169,000	50,000	3 38	104
Toledo, Ohio	8	695	17	5		625,000	125,000	5 00	
Washington, D. C.	18	328	283	76	404	4,495,237	277,000	16 22	685
Wilmington, Del	3	239.49	10	29.69	269.18	422,351.46	70,000	6 03	260

§ Figures corrected to 1900.
† Includes maintenance 7 years.
* Condemnation on hand for more land.
** Condemnation.
*** Maintenance.

Mexico as *palo verde*, from the bright green color of the branches. It stands drought even better than *P. aculeata*. These plants belong to the same tribe with such fine northern trees as Gleditschia and Gymnocladus and such southern kinds as Cæsalpinia, Poinciana and Colvillea.

A. *Lfts. numerous: rachis flat, long.*

aculeàta, Linn. Jerusalem Thorn. Small, glabrous tree, the slender branches often pendulous: spiny petioles ½–1 in. long: lfts. very small, oblong; rachis ½-1½ ft. long: racemes axillary, 3–6 in. long: fls. fragrant, pendulous. S.S. 3:131.

AA. *Lfts. few: rachis terete.*

Torreyàna, Wats. Small tree: lfts. 2 or 3 pairs: racemes terminating the branches: pedicels jointed near the middle, the joint not evident until in fr. Valley of the Colo. and eastward. F. Franceschi and W. M.

PARNÁSSIA (after Mt. Parnassus). *Saxifragàceæ.* Grass of Parnassus. About a dozen species of low-growing, moisture-loving, hardy perennial herbs, of tufted habit, each scape bearing a solitary, 5-petaled, white or yellowish flower ½–1½ in. across. They are suitable for shady positions along the water's edge, and are prop. by seeds or division. They generally grow about 6 in. high, but attain 2 ft. They bloom from June to September; the petals are conspicuously veined with 9 or more green lines. The plant which Dioscorides called "Grass of Parnassus" is *P. palustris*, the only species that is common in Europe. This is perhaps the best one for cult., but they are all much alike. Parnassias are suitable plants for moist, sunny or partially shaded positions. They prefer a peaty soil, but such is not necessary. The species are generally tenacious of life and are good perennials. The North Carolinian species are hardy North.

Parnassias are natives of the north temperate and arctic zones. Calyx 5-parted: petals withering, but persistent: fertile stamens 5, alternating with the petals: ovary 1-celled: style very short or none: stigmas usually 4: ovules many: capsule 1-celled, with 4 placentæ projecting within, 4-valved.

A. *Petals not clawed.*

B. *Rudimentary stamens 9–20 at the base of each petal.*

C. *Scape-leaf clasping.*

palústris, Linn. Grass of Parnassus. Lvs. ovate, usually cordate at the base: fls. ½–1 in. across: rudimentary stamens 9–15 at the base of each petal. Eu., Asia., N. Amer. Gn. 41, p. 500. A.G. 13:696.—In Eu. considered the commonest and best species, but in this country it seems to be advertised only by dealers in Japanese plants.

CC. *Scape-leaf not clasping.*

Califórnica, Greene. Height 1–2 ft.: lvs. ovate or ovate-oblong, 1–2 in. long; scape-leaf very small, and borne much above the middle: fls. 1½ in. across; rudimentary stamens about 20 at the base of each petal. Calif. Int. 1900, by Horsford.

BB. *Rudimentary stamens 3–5 at the base of each petal.*

Caroliniàna, Michx. Height 8–16 in.: lvs. ovate, broadly oval or orbicular, more or less cordate at the base; scape-leaf borne below the middle: fls. ¾–1½ in. across; rudimentary stamens usually 3 in each set. Swamps and low meadows, New Brunswick to Manitoba, south Va. to Ia. B.B. 2:182. B.M. 1459.—Commonest in cult.

AA. *Petals clawed.*

B. *Rudimentary stamens 3 at the base of each petal.*

asarifòlia, Vent. Height 10–16 in.: lvs. orbicular, kidney-shaped at the base, often 2–3 in. wide; scape-leaf clasping, borne at about the middle: petals not fringed. Wet places in high mts. of Va. and N. C. B.B. 2:184.

BB. *Rudimentary stamens 5–9 at the base of each petal.*

fimbriàta, Banks. Lvs. kidney-shaped to cordate-ovate: petals fringed below the middle. Colo. to Calif. and Brit. N. Amer. Int. by Gillett in 1881, and still cult.

P. nubicola, Wall. The largest and coarsest of all the species, and lacks the delicate beauty and white petals of P. palustris. Lvs. elliptic-ovate; scape-leaf borne below the middle: petals shorter than in the other kinds as compared with calyx lobes: rudimentary filaments 3, not topped by anthers. Himalayas. B.M. 6609. F. W. Barclay and W. M.

PARNASSUS, GRASS OF. See *Parnassia.*

PAROCHÈTUS (Greek, *near a lake*). *Leguminòsæ.* This plant was offered recently by A. Blanc, of Philadelphia, under the name of Shamrock Pea or Blue Oxalis. It is a half-hardy perennial trailer, with foliage like the shamrock, but with each of the 3 lfts. marked at the base with a handsome brown crescent; the pea-shaped fls., have a cobalt blue standard and pink wings. It is desirable for hanging baskets, pots and rockeries. Blanc says it blooms the year round. It is a native of tropical Asia and eastern Africa, ascending the Himalayas from 4,000 to 13,000 feet. If seeds could be secured from the greatest altitude the plants might be hardy in the North.

Parochetus is a genus of one species. It is allied to the clovers, sweet clover, medick and rest-harrow, and differs from them in having a more acute keel, a 2 valved pod, and the lfts. not stalked.

commùnis, Hamilt. Shamrock Pea. Blue Oxalis. Height 2–3 in.: rhizome thread-like, wide-creeping: petiole 2 in. long: lfts. obovate, emarginate, glabrous or slightly pubescent: peduncles 1–2-fld.: fls. ½–¾ in. across, axillary. F S. 15:1575.

PARONÝCHIA (old Greek name used by Dioscorides, meaning whitlow-wort, or a cure for a disease of the fingers or toes). Whitlow-wort. *Illecebràceæ*; by Britton and Brown referred to *Caryophyllàceæ.* About 40 species of annual or perennial herbs, natives of the Mediterranean region, erect or diffuse, often dichotomously branching: lvs. opposite, broad or narrow, entire, the margins flat or very rarely recurved; stipules prominent, scarious, shining: fls. minute, without petals, axillary or rarely in terminal cymes, usually densely clustered and hidden among the stipules. A few are cult. in the hardy border, and 2 are said to be much used in bedding. The two European species here given do not appear in the leading catalogues, domestic or foreign, but *P. serpyllifolia* is said to be much used for carpet bedding abroad. Allied to Herniaria, which see for generic differences. The species described below are perennials. *P. argentea* furnishes the Algerian tea of medicine.

A. *Lvs. rather broad, obovate or nearly so.*

B. *Foliage nearly glabrous.*

argéntea, Lam. Prostrate, diffuse: lvs. obovate to oblong or lanceolate: fls. lateral and terminal, dense, intermixed with lvs.: bracts ovate, acute, much longer than the fl.; calyx-lobes semi-scarious, hooded, mucronate on the back near the apex. Common in dry places, Mediterranean region.

BB. *Foliage ciliate at the margin.*

serpyllifòlia, DC. Prostrate, creeping: lvs. obovate, flat, rather fleshy: fls. terminal; calyx-lobes blunt. Arid parts of southern and eastern Eu.

AA. *Lvs. narrow, linear or awl-shaped.*

B. *Awns of the calyx-segments erect.*

argyrócoma, Nutt. Erect or ascending, 3–8 in. high, clothed with silvery, appressed, scale-like hairs: lvs. linear; stipules silvery white, scarious, entire, usually shorter than the lvs.: fls. in forking cymes: bracts large, silvery, membranous. Rocky places. Me. and N. H. to Ga. and Tenn. Also called Silver Chickweed, Silverhead, and Silver Whitlow-wort. B.B. 2:38.

BB. *Awns of the calyx-segments divergent.*

dichótoma, Nutt. Woody at the base, glabrous or puberulent, 4–14 in. tall; stipules entire, often 5–6 lines long, tapering into a slender awn: fls. in forking cymes. Dry soil, Md. and N. C. to Ark. and Tex. B.B. 2:39. Adv. 1883, by Woolson, Passaic, N. J. W. M.

Paronychia argyrocoma is an interesting little plant which shows remarkable geographical distribution; it occurs rather abundantly on the high rocky summits of the Carolina and Tennessee mountains, but does not appear northward in the Appalachian system till the peak of Mt. Washington is reached, where it grows sparingly; stations are also reported on several lower mountain tops in Maine. It is not difficult of cultivation and is prized for rockeries, its silvery tufted appearance lending a distinct charm to the collection for this purpose. Propagated by seeds and division.

HARLAN P. KELSEY.

PARRÒTIA (after F. W. Parrot, a German naturalist and traveler, afterwards professor of medicine at Dorpat; 1792–1841.). *Hamamelidàceæ.* Ornamental deciduous shrubs or small trees, with alternate, short-petioled, orbicular to oblong lvs., small fls. in dense heads appearing before the lvs., and with fr. similar to those of the Witch Hazel. The Persian species is hardy as far north as Mass. Its chief beauty consists in the brilliant autumnal tints of the foliage, which changes to golden yellow, orange and scarlet and remains a long time on the branches. The early appearing fls., with the purple pendulous stamens, are also attractive. The Himalayan species is much more tender and its foliage turns only to pale yellow, but the fls. are somewhat more showy from their rather large white bracts. The Parrotias grow in any well-drained soil and like a sheltered position. Prop. by seeds and layers and also by greenwood cuttings under glass. Two species in N. Persia and the Himalayas. The short petioles have large deciduous stipules: fls. small, in dense heads, surrounded by an involucre of several bracts; petals wanting; calyx 5–7-lobed, embracing the pubescent ovary about one-half; stamens 5–15; styles 2: capsule 2-celled, with 2 beaks, dehiscent between the beaks, with one oblong shining seed in each cell. The wood is very close-grained, hard and strong, and *P. Persica* bears therefore the name Ironwood. The tough pliable branches of the Himalayan species are extensively used for basket-work and are also twisted into thick ropes used for the construction of twig-bridges over the great rivers of its native country.

Pérsica, C. A. Mey. Shrub or small tree, to 15 ft., with spreading branches: lvs. oval to obovate-oblong, obtuse, coarsely and crenately dentate above the middle, dark green above, pubescent beneath when young, 3–4 in. long: bracts of flower-heads covered with dark brown tomentum: stamens 5–7, pendulous, with linear-oblong, purple anthers: fr. with recurved beaks. N. Persia. B.M. 5744.

Jacquemontiàna, Decaisne (*Fothergilla involucràta*, Falc.). Spreading shrub or small tree, to 20 ft.: lvs. orbicular, crenately toothed, stellate-pubescent on both sides, 2–4 in. long: heads many-fld., with spreading white bracts sprinkled with a purplish scurf on the back: stamens about 15, erect, with yellow, oval-oblong anthers. Himalayas. B.M. 7501. ALFRED REHDER.

PARROT'S BILL. See *Clianthus.*

PÁRRYA (Capt. W. E. Parry, Arctic explorer). *Cruciferæ.* Four or five North American and a few Asiatic low perennial scape-bearing herbs, with thick roots or caudices, narrow leaves and mostly racemose, white or purplish showy flowers: pod broad and flat, mostly elliptic, with orbicular seeds. The Parryas are alpine or boreal, often arctic plants, and some of them will no doubt prove useful for the alpine garden. So far they are practically unknown in American gardens. In 1881, Gillett introduced **P. Ménziesii**, Greene (as *Cheiranthus Menziesii*, Benth. & Hook.). It has a leafy scape 3–8 in. high, with a raceme of many flowers, the petals nearly ½ in. long and bright purple. N. Calif., north to the Lower Columbia river. L. H. B.

PARSLEY. Fig. 1647. While indispensable in the market garden, Parsley is but rarely found in our home gardens. The addition of a bit of Parsley foliage, finely chopped, heightens the flavor of soups, fish, etc. The principal use of this vegetable, however, is for garnishing meats and fish, and for this purpose it seems to be the vegetable par excellence, equally desirable in the home as on the hotel table. A very few plants will suffice for the home garden, and any spot of good soil will do for starting them from seed. Sow as early in spring as practicable, either in an early hotbed or coldframe, or in open ground. Parsley seed germinates somewhat slowly, and the plants are feeble at first. In open ground, early sowing aids the plants to get ahead of the weeds. In larger patches the rows should be a foot apart, and seed sown rather thinly in shallow drills. Thin the plants to stand a few inches apart, and cultivate same as carrots. Gather the leaf-stalks as needed. For use during winter and early spring, start plants in open ground in early fall, and on the approach of cold weather set them in a corner of the greenhouse bench, or in a box or keg filled with rich loam placed in a light kitchen or cellar window.

1647. Curl-leaved Parsley.

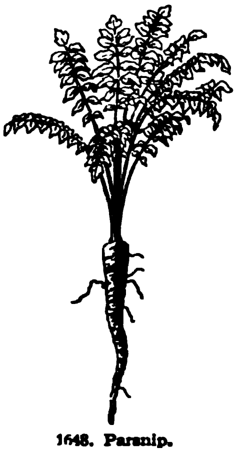
When the plant is a year old (sooner or later), it throws up seed-stalks, and produces seed in abundance, even under glass protection. By keeping the seed-stalks closely cut out, the season of leaf-yield may be prolonged for a time. Seed is easily gathered and cleaned.

The varietal differences appear chiefly in the foliage, which in some sorts is rather coarse, as in the Plain or Common, or more finely divided, as in the Curled, Double Curled, Moss Curled and Fern-Leaved.

For the botany of Parsley, see *Carum Petroselinum.*

T. GREINER.

PARSNIP (*Pastinaca sativa*). Fig. 1648. The average home gardener thinks much of quick results. The drawback to Parsnip growing, in his estimation, is the length of time which the crop requires for its development. When seed is sown, in early spring, the harvest seems a long way off. To offset this disadvantage, however, Parsnips become available as green material when other things fresh from the garden are very scarce or entirely absent, namely, during open spells in winter, and in the very early spring months. A crop of good, straight roots may not be quite as easily produced as a crop of smooth carrots, but when once grown, it does not burden one with much responsibility in regard to storage or keeping, which is an important point in its favor. The roots may be left in the ground where they grew or stored in moss or sand in the cellar. This feature makes them valuable also as food for cattle, sheep, hogs and poultry in the early spring in case the table or market should not call for them at that time.


1648. Parsnip.

The best soil for Parsnips is a clean, rich loam, which offers no obstruction to the uniform expansion of the roots. Prepare it the same as for beets or carrots, or for any other garden crop. The seed should be strictly fresh, as it soon loses its vitality. Sow it in early spring, preferably with a garden seed-drill, ½-1 in. deep, in rows 15-20 in. apart in the garden, and somewhat farther in field culture. Be prompt in thinning the young seedlings to 3-4 in. apart in the row; at the same time pull up or cut out all weeds. The free use of the hand wheel-hoe will keep the patch clean until the entire surface of the ground is covered with foliage, thus preventing further growth of weeds. Cultivation may then cease.

The varieties are few in number. For shallow, stony or otherwise unfavorable soils we have the Round or Early Short Round; for better soils the Half-Long, Student, or Hollow Crown; and for deep, clean soils the Long Smooth.

Seed is easily grown. Plant the roots in spring in any good soil, and gather the seed heads when most of the seeds in them are mature. Dry them on sheets, and then thrash or strip.

For botanical account of Parsnip, see *Pastinaca*.

T. GREINER.

PARTHÈNIUM integrifòlium, the American Feverfew or Prairie Dock, has been offered by one dealer in hardy herbaceous perennials, but the plant is desirable only for foliage effects; and the fls. are not showy. It is pictured in B.B. 3:411 and described in American manuals. The genus has little horticultural value.

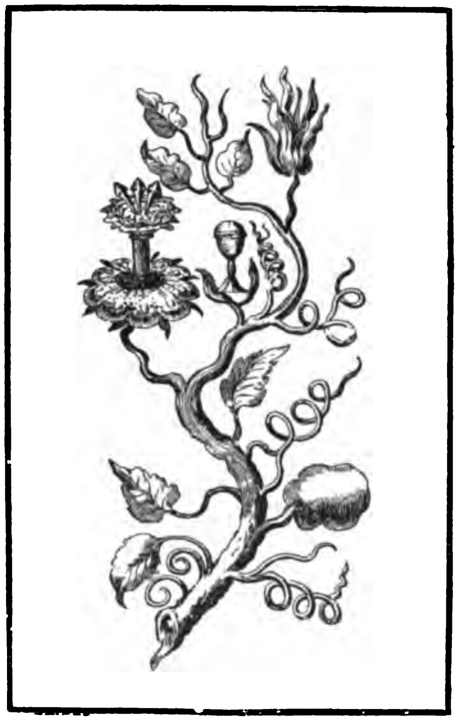
PARTRIDGE-BERRY. *Mitchella repens*. Sometimes applied to *Gaultheria procumbens*.

PASCÀLIA glaùca is a composite from Chile which is probably not in cult. The plant cult. under this name in England, and once offered by John Saul, is probably the plant shown in P.M. 8:125, which is believed to be a Helianthus. It is not hardy and there seems to be little reason for cultivating it here, because we have so many hardy sunflowers.

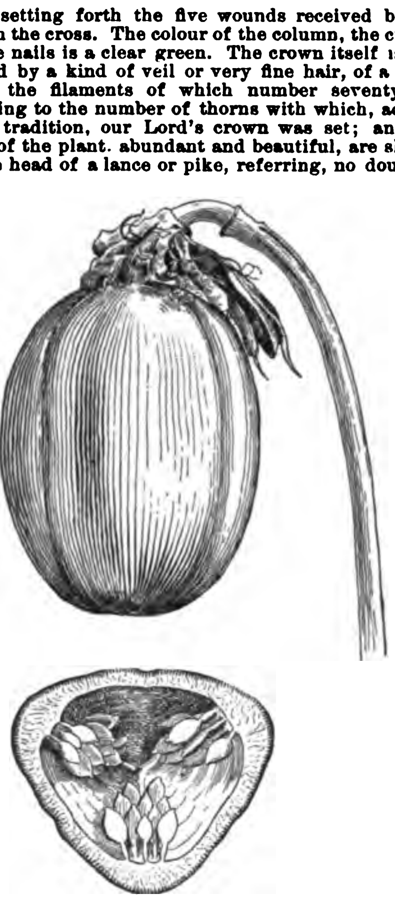
PASQUE FLOWER. *Anemone Pulsatilla*.

PASSIFLÒRA (i. e., *Passion flower*). *Passifloràceæ*. PASSION-FLOWER. A large tropical genus of highly interesting herbs, shrubs, or trees, but most of them climbing by means of tendrils. The peculiar charm of these plants lies in the odd flowers, the parts of which were fancied by the early Spanish and Italian travelers to represent the implements of the crucifixion (whence both the technical and popular names). The flower is usually subtended by 2 or 3 calyx-like bracts. The calyx has 5 petal-like lobes. The corolla is of 5 petals. The ten colored parts of the floral envelope were thought to represent the 10 apostles present at the crucifixion, Peter and Judas being absent. Inside the corolla is a showy crown or corona of colored filaments or fringes, taken to represent the crown of thorns, or by some thought to be emblematic of the halo. The stamens are 5, to some suggestive of the five wounds, by others thought to be emblematic of the hammers which were used to drive the three nails, the latter being represented by the 3 styles with capitate stigmas. The long axillary coiling tendrils represented the cords or the scourges. The digitate leaves suggested the hands of the persecutors. Fig. 1649 is an old representation of the Passion-flower. Consult *Tacsonia*.

The following sketch of the Passion-flower legend is from Folkard's "Plant Lore, Legends and Lyrics," and the illustration (Fig. 1649) is also reproduced from that book: "The Passion-flower (*Passiflora cærulea*) is a wild flower of the South American forests, and it is said that the Spaniards, when they first saw the lovely bloom of this plant, as it hung in rich festoons from the branches of the forest trees, regarded the magnificent blossom as a token that the Indians should be converted to Christianity, as they saw in its several parts the emblems of the passion of our Lord. In the year 1610, Jacomo Bosio, the author of an exhaustive treatise on the cross of Calvary, was busily engaged on this work when there arrived in Rome an Augustinian friar, named Emmanuel de Villegas, a Mexican by birth. He brought with him, and showed to Bosio, the drawing of a flower so 'stupendously marvelous, that he hesitated making any mention of it in his book. However, some other drawings and descriptions were sent to him by inhabitants of New Spain, and certain Mexican Jesuits, sojourning at Rome, confirmed all the astonishing reports of this floral marvel; moreover, some Dominicans at Bologna engraved and published a drawing of it, accompanied by poems and descriptive essays. Bosio, therefore, conceived it to be his duty to present the *Flos Passionis* to the world as the most wondrous example of the *Croce trionfante* discovered in forest or field. The flower represents, he tells us, not so directly the cross of our Lord, as the past mysteries of the passion. It is a native of the Indies, of Peru, and of New Spain, where the Spaniards call it 'the Flower of the Five Wounds,' and it had clearly been designed by the great Creator that it might, in due time, assist in the conversion of the heathen among whom it grows. Alluding to the bell-like shape assumed by the flower during the greater part of its existence (i. e., whilst it is expanding and fading), Bosio remarks: 'And it may well be that, in his infinite wisdom, it pleased him to create it thus shut up and protected, as though to indicate that the wonderful mysteries of the cross and of his passion were to remain hidden from the heathen people of those countries until the time preordained by His Highest Majesty.' The figure given to the Passion-flower in Bosio's work shows the crown of thorns twisted and plaited, the three nails, and the column of the flagellation just as they appear on ecclesiastical banners, etc. 'The upper petals,' writes Bosio in his description, 'are tawny in Peru, but in New Spain they are white, tinged with rose. The filaments above resemble a blood-coloured fringe, as though suggesting the scourge with which our blessed Lord was tormented. The column rises in the middle. The nails are above it; the crown of thorns encircles the column; and close in the center of the flower from which the column rises is a portion of a yellow colour, about the size of a reale, in which are five spots or stains of the hue of blood, evi-


1649. Old conception of the Passion-flower.
From Folkard's "Plant Lore," and there taken from Zahn.

dently setting forth the five wounds received by our Lord on the cross. The colour of the column, the crown, and the nails is a clear green. The crown itself is surrounded by a kind of veil or very fine hair, of a violet colour, the filaments of which number seventy-two, answering to the number of thorns with which, according to tradition, our Lord's crown was set; and the leaves of the plant, abundant and beautiful, are shaped like the head of a lance or pike, referring, no doubt, to that which pierced the side of our Savior, whilst they are marked beneath with round spots, signifying the thirty pieces of silver.'"



1650. Fruit of the May-pop.—Passiflora incarnata. Natural size.

With the exception of a few Malayan and Chinese species, the true Passifloras are natives of tropical America. Many of them are cultivated as curiosities, and some of them for the beauty of their flowers and for their festooning foliage. The leaves are either digitately lobed or angled or perfectly entire. The large, showy flowers are solitary in the axils or on axillary racemes. The fruit is oblong or globular and usually fleshy or berry-like, 3-carpeled but 1-loculed, the seeds being borne on parietal placentæ. The fruit is allied to the pepo of the Cucurbitaceæ. The ovary is supported on a long stalk which is inclosed in or usually united with the tube formed by the union of the bases of the filaments. The structure of the fruit is well shown in Fig. 1650; the remains of the floral envelopes have broken from the attachment on the torus and rest on the fruit. The petals are borne on the throat of the calyx, but in some species they are absent. Nearly or quite a dozen Passifloras are native to the U. S., and one of them, *P. lutea*, grows naturally as far north as southern Pa. and Illinois. From Virginia south, the Maypop, *P. incarnata*, is a very common plant in fields and waste places. Both these species are herbaceous perennials. The fruit of some Passifloras is edible.

In cultivation, the Passifloras have been considerably hybridized, and they are also confused with Tacsonia. In 1871 Masters enumerated 184 species (Trans. Linn. Soc. 26), and a number of species have been discovered since that time.

Most of the Passion-flowers are yellow or green in color of envelopes, but there are fine reds in *P. racemosa*, *P. Raddiana*, *P. coccinea*, *P. alata*, *P. vitifolia*, and two or three others. L. H. B.

P. cærulea and Constance Elliott are both hardy at Washington. In summer time we use *P. fœtida* (raised from seed annually), and during the last two seasons, *P. Colimensis*, for trellis work. The last named is a good thing for this line of work; the fls. are white, purple center, about 2 in. in diameter; native of Mexico; very easy to prop. from cuttings of soft wood. Not many of the tender species and hybrids are grown to any great extent in this country. *P. alata* and *P. quadrangularis* are desirable climbers for a roomy, warm greenhouse. *P. quadrangularis*, var. *aucubifolia*, seems to flower quite as freely as the green-leaved one. Passifloras are prop. from cuttings of the half-ripened growth, with bottom heat. *P. racemosa* and *P. Loudoni* are a trifle difficult to root from cuttings; the growths should be as ripe as possible for this purpose. Keep the under surface of the leaves flat on the sand while rooting. The native *P. incarnata* grows very freely at Washington, becoming more or less of a weed and hard to eradicate.

G. W. OLIVER.

INDEX.

acerifolia, 2.
adenopoda, 2.
alata, 11.
alato-cærulea, 23.
alba, 20.
amabilis, 7, 13.
atomaria, 20.
Brasiliensis, 11.
Buchanani, 16.
cærulea, 22.
coccinea, 15.
Colimensis: see supplementary list.
Constance Elliott 22.
Decaisneana, 12.
edulis, 18.
fœtida: see supplementary list.
fulgens, 15.
gracilis, 1.
grandiflora, 22.
Hahnii, 3.
incarnata, 17.
kermesina, 8.
latifolia, 11.
laurifolia, 14.
Lawsoniana, 11.
ligularis, 6.
Loudoni, 8.
Lowei, 6.
lutea, 5.
maliformis, 11.
Mauritiana, 11.
Mascarensis, 11.
oviformis, 11.
Pfordtii, 23.
phœnicea, 11.
princeps, 7.
pruinosa, 19.
pubescens, 16.
quadrangularis, 10.
racemosa, 7.
Raddiana, 8.
sanguinea, 16.
tinifolia, 14.
trifasciata, 4.
variegata, 10.
velutina, 15.
violacea, 21.
vitifolia, 16.
Watsoniana, 9.

A. *Corona with sharp folds, and crinkled at the edge.*

B. *Fls. apetalous, usually with no bracts.*

1. **grácilis**, Jacq. Slender annual: lvs. rather small, broadly deltoid-ovate, very shallowly and bluntly 3-lobed: fls. solitary, pale green or whitish, considerably surpassed by the lvs., the calyx-lobes oblong or lanceolate, the filiform rays of the corona in a single row and equal: seeds with 6 elevated ridges. Brazil. B.R. 11:870. —Fl. about 1 in. across. Easily grown either indoors or in the open, as a garden annual.

BB. *Fls. petaliferous, with large bracts.*

2. **adenópoda**, Moc. & Sess. (*P. acerifòlia*, Cham. & Schlecht.). Lvs. glabrous, cordate, 3-nerved and 5-lobed, the lobes ovate-acuminate and somewhat serrate: bracts cut-serrate. Mex. to S. Amer.—Once advertised by Saul.

3. **Háhnii**, Mast. Tall, glabrous climber, with very slender terete branches: lvs. ovate, peltate at base, strongly 3-nerved and each of the side nerves ending in a tooth, but the leaf-margin otherwise entire but bearing minute red glands: stipules kidney-shaped, dentate, purplish, nearly or quite 1 in. across: fl.-bracts 2, entire: fl. about 3 in. across, solitary, whitish, the corona shorter than the envelopes, the outer filaments being orange. Mex. B.M. 7052. R.H. 1869, p. 430 (as *Disemma Hahnii*). G.C. II. 12:504.

BBB. *Fls. with minute petals and small linear distinct bracts.*

C. *Leaves oblong-ovate.*

4. **trifasciàta**, Lem. Lvs. 3-lobed to one-third or one-half their depth, the margins entire, with an irregular reddish purple band along each of the three midribs: fls. yellowish, fragrant, small. Brazil. I.H. 15:544.—Interesting for its ornamental foliage.

CC. *Leaves broader than long.*

5. **lùtea**, Linn. Herb, 5–10 ft. tall, glabrous: lvs. broader than long, shallowly 3-lobed, cordate at base:

fls. solitary, about ¾ in. across, greenish yellow: fr. a globular berry about ½ in. in diam. Pa. south and west. B.R. 1:79.—It has been offered by dealers in native plants.

AA. *Corona not crinkled or folded on the edge, plane or nearly so.*

B. *Bracts grown together.*

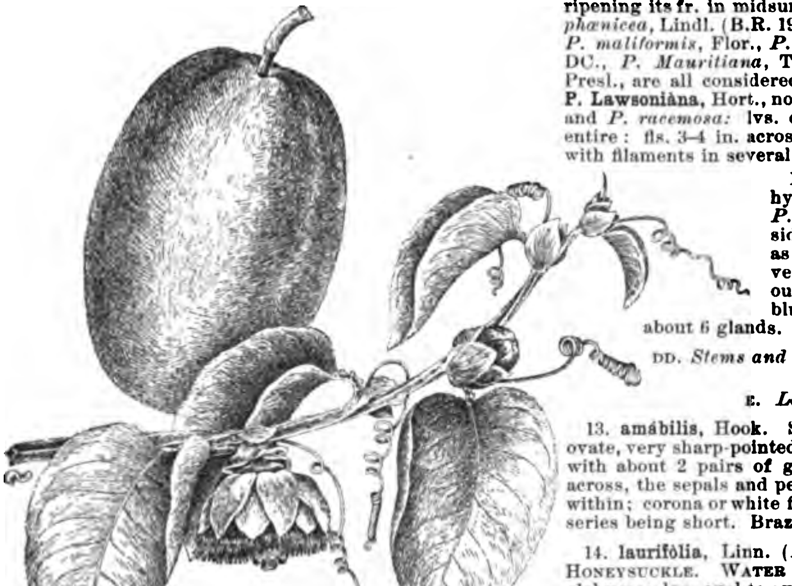
6. **ligulàris,** Juss. (*P. Lòwei*, Heer). Woody below, tall, branchy: lvs. large, cordate, ovate-acuminate, neither lobed nor toothed: fls. solitary, the petals and sepals greenish, the corona white, with zones of red-purple: fr. said to be the size of an orange. Trop. Amer. B.M. 2967.—Young foliage has metallic hues.

BB. *Bracts free.*

C. *Tube of flower evident and cylindrical, swollen at the base.*

7. **racemòsa,** Brot. (*P. princeps*, Hort. *P. amàbilis*, Hort., in part). Lvs. glabrous, usually truncate at base, mostly deeply 3-lobed, the margins entire: fls. 4 in. or more across, the narrow petals deep red and wide-spreading, the short, upright crown purplish; calyx keeled on the lower side: fls. solitary, but the peduncles usually 2 from an axil, becoming racemose on the ends of the shoots: bracts 3. Brazil. B.M. 2001. B.R. 4:285. L.B.C. 1:84. Gn. 39:793.—A fine old species and a parent of various garden hybrids. The best of the red-flowered Passifloras. Summer and fall.

8. **Raddiàna,** DC. (*P. kermesina*, Hort.). Rather slender: lvs. shallow-cordate, 3-lobed and sparingly dentate, purplish beneath: fls. with very narrow distinct sepals and petals of a bright crimson-red, which are wide-spreading at first but finally turning almost straight back: crown black-purple, upright, with smaller whitish filaments inside. Summer and fall. Brazil. B.M. 3503. B.R. 19:1633.—An old and well-known species, and deservedly popular. **P. Loùdoni,** Hort., is considered to be a hybrid of this and *P. racemosa*.



1651. Granadilla, Passiflora quadrangularis (×¼).

9. **Watsoniàna,** Masters. Stems wiry, purplish, with leafy dentate stipules: lvs. shallow-cordate, rather broader than long, 3-lobed to the middle, with a few teeth: peduncles 1-fld.: fls. about 3 in. across, the sepals linear and shaded with violet; petals also very narrow, lilac: crown of many rows of filaments, violet with bars of white below the middle, the inner and shorter set deep violet. Probably Brazilian. G.C. II. 26:648-9. I.H.36:74. Gn. 33:638. A.F. 6:571.—Good grower.

CC. *Tube of flower very short, thick or fleshy in substance.*

D. *Stems and branches strongly 4-angled or even winged: lvs. simple.*

10. **quadrangulàris,** Linn. GRANADILLA. Fig. 1651. Tall strong climber, glabrous: lvs. ovate or round-ovate, cordate at base, mucronate, entire, the petiole with 2 or 3 pairs of glands: stipules large: fl. large (3 to 5 in. across) and interesting, fragrant, with ovate sepals and petals (the former white within and the latter reddish), the crown composed of 5 series of white-and-purple parti-colored filaments, of which the outermost exceed the floral envelopes: fr. oblong, 5-9 in. long, yellowish green, pulpy and edible. Tropical Amer. B.R. 1:14. Gn. 51, p. 313. R.H. 1898, p. 569. Gn. 59, pp. 4, 7.—Widely grown in the tropics, and variable, both as a vine and for its edible fruits. Frequent in collections of economic plants in the North. It is a good climber for covering a greenhouse roof. Best results are secured if the temperature does not fall below 50°. The fruit ripens in summer. The fls. usually need to be hand-pollinated if fruit is wanted on house-grown plants. Var. **variegàta,** Hort. (*P. variegàta*, Hort.), has foliage blotched with yellow.

11. **alàta,** Dryand. Stem winged: lvs. glabrous, oval to ovate, somewhat cordate at base, the margin often undulate but otherwise entire, the petiole with 2 pairs of glands: fl. 3-4 in. across, very fragrant, the interior of the sepals and petals carmine; corona nearly or quite as long as the envelopes, the numerous filaments parti-colored with red, purple and white: fr. yellow, ovoid-pointed, about 5 in. long, very fragrant and one of the most edible. S. Amer. B.M. 66. G.C. III. 15:19; 22:449-51. R.B. 20, p. 104.—An excellent old species, ripening its fr. in midsummer. It is very variable. *P. phœnicea*, Lindl. (B.R. 19:1603), *P. Brasiliensis*, Desf., *P. maliformis*, Flor., *P. oviformis*, Rœm., *P. latifolia*, DC., *P. Mauritiana*, Thouars, and *P. Mascarensis*, Presl., are all considered to be forms of this species. P. **Lawsoniàna,** Hort., not Mast., is a hybrid of *P. alata* and *P. racemosa:* lvs. oblong-oval, somewhat peltate, entire: fls. 3-4 in. across, brownish inside, the corona with filaments in several series.

12. **Decaisneàna,** Hort., is a hybrid of *P. quadrangularis* and *P. alata:* fls. bright carmine inside, about 4 in. across; corona as long as or longer than the envelopes, the more or less tortuous filaments banded with deep blue and white: lvs. bearing about 6 glands. R.H. 1855:281. F.S. 8:848.

DD. *Stems and branches terete, or at least not winged.*

E. *Leaves not lobed.*

13. **amábilis,** Hook. Stem slender and terete: lvs. ovate, very sharp-pointed, entire, rather thin, the petiole with about 2 pairs of glands: fl. solitary, about 3 in. across, the sepals and petals alike and bright brick-red within; corona or white filaments in 4 series, the 2 inner series being short. Brazil. B.M. 4406. Gn. 55:1219.

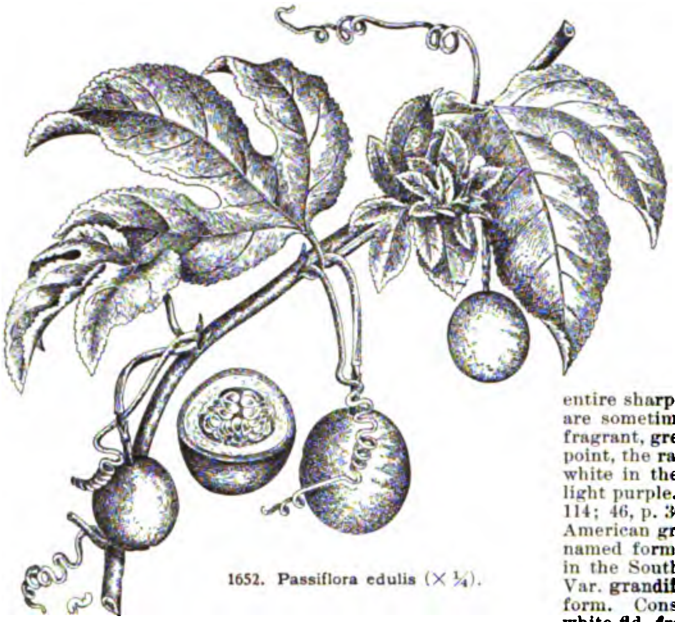
14. **laurifòlia,** Linn. (*P. tinifòlia*, Juss.). JAMAICA HONEYSUCKLE. WATER LEMON. Stem terete, plant glabrous: lvs. oval to oval-oblong, thickish, entire, with a short sharp point: petiole with 2 glands: fl. about 2½ in. across, white, with red spots or blotches; corona somewhat exceeding the petals or at least about equaling them, in 3 series, violet with white bands: fr. about 3 in. long, yellow, spotted with white, edible. Trop. Amer. B.R. 1:13. B.M. 4958.

15. **coccinea,** Aubl. (*P. velùtina*, DC. *P. fùlgens*. Morr.). Glabrous: lvs. ovate and coarsely toothed; petioles with 2-3 pairs of glands: fl. scarlet; corona orange: fr. pulpy and edible. S. Amer. The fr. is said to contain "a chemical principle of hypnotic value."

EE. *Leaves 3-7-lobed.*

F. *Blossoms bright red.*

16. **vitifòlia,** HBK. (*P. sanguinea*, Smith. *P. pubéscens*, DC. *Tacsònia Buchànani*, Lem.). Stem terete: lvs. cordate-ovate in outline, deeply 3-lobed or divided and the divisions coarsely toothed, strong-veined, usually pubescent beneath: fl. 4–6 in. across, nearly flat, the linear-oblong sepals and petals bright scarlet, the sepals with a spine at the tip; outer corona filaments red, the inner ones white, all of them upright or spreading and much shorter than the envelopes. Brazil. F.M. 1878:317. G.C. III. 8:213.—An old species, but not common in cult. Said not to be free-flowering.



1652. Passiflora edulis (× ¼).

FF. *Blossoms white, greenish, purplish, or variously tinted, but not red.*

G. *Rays of corona (or the outer ones) about as long as the floral envelopes: leaf-margins strongly serrate (except sometimes in No. 19).*

17. **incarnàta,** Linn. MAY-POP. Fig. 1650. Tall-climbing strong vine, glabrous or nearly so: lvs 3-lobed to about half their depth, broadly cordate-ovate in outline, serrate, the petiole bearing 2 glands near the top: fl. axillary and solitary, about 2 in. across, white, with a light purple corona banded at its center: fr. oblong, about 2 in. long, with 3 sutures, yellow when ripe. Dry places, Va., south and west. B.M. 3697. Mn. 9:17.—A weedy plant, but offered by dealers in native plants. With protection, the roots will survive the winter as far north as Baltimore, and the strong herbaceous vines will make a fine cover for arbors and verandas. Easily grown from seeds.

18. **èdulis,** Sims. Fig. 1652. More woody and stronger: lvs. large, deeply 3-lobed and serrate: fl. white, often tinted with purple, the rays nearly as long as the envelopes, white for the upper half but purple at the base: fr. globular-oblong, thickly purple-dotted when ripe, the rind hard. Brazil. B.M. 1989. R.H. 1857, p. 224; 1883, p. 489. Gn. 50:1093. G.C. III. 23:101. A.G. 13:120.—Runs into several forms. The fruit is fragrant and edible, but there is little pulp, the seeds occupying most of the interior. Readily grown from seeds. Naturalized in tropical countries.

19. **pruinòsa,** Mast. Climbing, the stems terete, glabrous: lvs. broad in outline, 3-lobed beyond the middle, the lateral lobes diverging, the margins remotely glandular-toothed, glaucous beneath: stipules very large and leaf-like, cordate, 2 in. long: fl. 3 in. across, pale or pearly violet, the corona of numerous filaments, the outermost of which are nearly as long as the petals and are deep violet at the base, yellowish in the middle and curly at the top. British Guiana. G.C. III. 22:393.—First described in 1897, and now offered in this country by Sander & Co.

GG. *Rays distinctly shorter than envelopes: leaf-margins nearly or quite entire.*

20. **àlba,** Link & Otto. (*P. atomària*, Planch.). Stem terete: stipules very large and leaf-like: lvs. broad-ovate and somewhat cordate, rather shallowly 3-lobed, glaucous beneath, the margins entire: peduncles exceeding the lvs., 1-fld.: fl. little more than 2 in. across, clear white: fr. obovoid, the size of an egg, green at first, but becoming yellowish. Mex. to S. Amer. G. C. II. 19:693. R.H. 1883, p. 201; 1884:36.

21. **violàcea,** Vell. Tall, glabrous, with drooping branches: lvs. straight at base and somewhat peltate, with 3 long, narrow lobes, of which the side ones stand at nearly right angles to the central one, the margins entire or with a few teeth in the bottom of the sinus, the under surface slightly glaucous: fl. about 3 in. across, the petals and sepals lilac-pink inside (sepals ending in a long spur), the numerous filaments of the corona white-tipped and barred with violet and white. Brazil. B.M. 6997. R.H. 1885:468.

22. **cærùlea,** Linn. Fig. 1653. Slender, but a strong grower, glabrous and somewhat glaucous: lvs. divided nearly to the petiole into 5 lanceolate or lance-elliptic entire sharp-pointed segments of which the 2 lower ones are sometimes again lobed: fl. 3–4 in. across, slightly fragrant, greenish white, the sepals tipped with a short point, the rays of the corona in 2 series, blue at the tip, white in the middle and purple at the base, the styles light purple. Brazil. B.M. 28. Gn. 31, p. 421; 34, p. 114; 46, p. 369.—The commonest of Passion-flowers in American greenhouses, and now represented by several named forms and hybrids. Can be grown in the open in the South and in Calif. as far N. as San Francisco. Var. **grandiflòra,** Hort., is only a somewhat larger-fld. form. Constance Elliott (*P. cærulea*, var. *alba*), is a white-fld. fragrant form. Gn. 31:595. There are hybrids with *P. Raddiana*, *P. racemosa*, *P. alata*, and others. *P. cærulea* grows readily from seeds.

23. **alàto-cærùlea** (*P. Pfórdtii*, Hort.) is a white-fld. form, with calyx tinted rose inside, and corona of 3 series, the outer filaments being white at tip, blue-purple in the middle, and black-purple at the base. B.R. 10:848. R.H. 1847:121.

Passifloras in the Amer. trade, but not accounted for botanically, are: *P. cardinalis*, "scarlet flowers;" *P. Paraguayi*, Blanc, 1900; *P. Paxtoni; P. rosea; P. Schmittii*, "bright carmine." *P. insignis*, *Jamesoni*, *manicata*, *Parritæ* are to be sought in Tacsonia.

Species which may be expected in the trade are: *P. chelidònea*, Mast. Lvs. oblong, forked at the end to one-fourth the length and with a small middle lobe, marked with dots: fl. 2 in. across, greenish, with a folded corona. Ecuador. G.C. II. 12:40.—*P. cinnabarina*, Lindl. Branches terete: lvs. broad-ovate, 3-lobed, margins entire: fl. solitary, 2½ in. across, red; corona short, folded, yellowish. Australia. G.C. 1855:724. B.M. 5911.—*P. Coliménsis*, Mast. & Rose. A Mexican species first described in 1899, but cult. for several years in Washington. It is an herbaceous species, with shallow-lobed obtuse denticulate lvs. and small whitish blue-marked fls. on single peduncles. Promising as an outdoor climber, p. 1220. —*P. fœtida*, Linn. (P. hirsuta and P. hircina, Hort.). Allied to P. adenopoda: annual or sometimes perennial: lvs. pubescent, 3-lobed, the margins entire or obscurely angled: fls. whitish, small, the corona as long as the petals and colored purple and blue: fl.-bracts pinnatifid. Trop. Amer. L.B.C. 2:136. B.M. 3635, the form known as var. nigelliflora, Mast.; and 288, the var. ciliata, Mast. In cult. in this country, but apparently not in the trade. Variable.—*P. galbàna*, Mast. Stems terete: lvs. lance-oblong, short-petioled, entire: stipules ovate-pointed: fl. solitary on a long peduncle, 3 in. across, greenish yellow, the sepals and petals very narrow, the not folded corona short. Brazil. G.C. III. 20:555.—*P. Im Thúrnii*, Mast. Lvs. broad-oblong, acute, entire, thick, glabrous above, but not beneath: fl. erect, 4–5 in. across, brilliant scarlet and rose color, with white in the center: corona very short.

British Guiana. G.C. III. 23:307. Very showy.—*P. Kewénsis*, Hort. "It is a cross raised by Mr. Watson, the assistant curator, between the hardy Passiflora cœrulea and the Brazilian P. Raddiana. The flowers are larger than those of P. Raddiana, the petals and fringe longer, while the color is carmine suffused with blue, which, though perhaps not so bright and pleasing as it is in the parent, is a lovely color."—*P. Miersii*, Mast. Stems slender and wiry: lvs. lance-ovate and entire, claret-colored beneath: fl. 2 in. across, white, shaded with pink, the corona half the length of the petals, white, barred with purple. Brazil. G.C. III. 4:353.—*P. tríloba*, Ruiz & Pav. Lvs. large, cordate-ovate, 3-lobed or entire: fl. 3 in. across, with violet reflexed sepals and petals, and a long cup-like corona, with filaments banded white and purple. Peru. I.H. 36:83.—*P. Weberiàna*, André. Glandular-hairy: lvs. large, 3-lobed, the margin usually toothed: fl. solitary, 2 in. across, white, the corona banded with white: fr. setose, purple. Argentina. R.H. 1887:324.

L. H. B.

PASSION FLOWER. See *Passiflora*.

PASTINÀCA (name from the Latin *pastus*, food). *Umbelliferæ*. About a half dozen species of tall herbs native to Europe and Asia, but by Bentham & Hooker united with the genus Peucedanum. It is distinguished from Heracleum and Peucedanum by technical characters of the fruit. Pastinaca is known to horticulturists in the Parsnip (which see), *P. sativa*, Linn. It is a native of Europe, but is now grown in nearly all cool-temperate countries for its large edible root. In deep moist soil and a cool climate, the edible roots become 18–20 inches long and four inches or more in diameter at the crown. It was cultivated before the Christian era. It has run wild from gardens, often becoming a bad weed in neglected fields and on roadsides. *P. sativa* is a robust plant, sending up a grooved stem (which becomes hollow) 3–5 ft.: lvs. odd-pinnate, with 3–4 pairs of sessile ovate-oblong sharp-toothed and notched leaflets, the terminal leaflet 3-lobed: fruit ("seed") thin and flat, retaining its vitality only a year or two. When run wild, it loses its thick root, and sometimes it becomes annual.

L. H. B.

PATCHOULI PLANT. See *Pogostemon*.

PATIENCE. Patience Dock or Herb Patience is *Rumex Patientia*.

PATRÍNIA (E. L. Patrin, 1742–1814, French traveler in Siberia). *Valerianàceæ*. About 10 species of yellow- or white-fld., valerian-like, hardy herbaceous perennials from extra-tropical Asia. They grow a foot or so high, bloom in early summer and may have about 20 small fls. in clusters 2 in. across. Two species are offered by dealers in Japanese plants.

Patrinia is distinguished from the other 8 genera in the Valerian family by 4 stamens and mostly yellow fls. Valeriana has 3 stamens. Nardostachys, with 4 stamens, has purple fls. Patrinias are glabrous or loosely villous: lvs. once or twice pinnatifid or -sect, the radical ones rarely entire: cymes corymbose-panicled: bracts narrow, free, but sometimes appendaged with a large, 2-nerved and netted-veined bracteole which is appressed to the fr.: corolla-tube very short; lobes 5, spreading: sterile locules of the fruit nearly as large or larger than the fertile ones.

A. *Stem glabrous.*

scabiosæfòlia, Fisch. Radical lvs. ovate or oblong, incised-serrate and lyrate: cauline lvs. pinnatifid, the lobes lanceolate-linear, acute, terminal one longest: fls. yellow: corymb loosely subpaniculate: fr. 3-cornered. Dahuria. L.B.C. 14:1340.

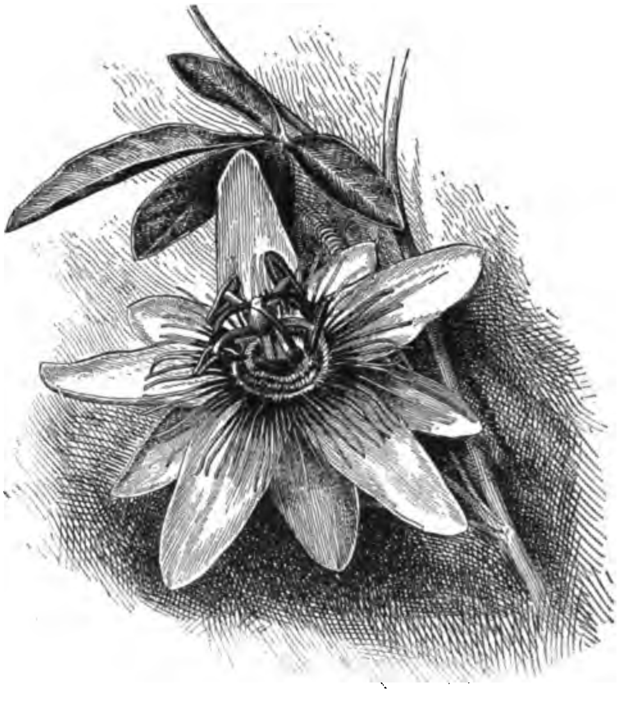
AA. *Stem villous.*

villòsa, Juss. Radical lvs. villous, petiolate, auricled: cauline lvs. sessile, dentate: corymb panicled. Japan. —The plant offered by the Yokohama Nursery Co. is said to have white fls.

PAULLÍNIA (probably after Simon Paulli, 1608–1680, professor of anatomy, surgery and botany at Copenhagen). *Sapindàceæ*. *P. thalictrifolia* is a handsome stove foliage plant, with much divided lvs. somewhat resembling a rue, maidenhair, or a davallia. The fls. are inconspicuous, pinkish and borne in autumn. In the early seventies, when the interest in foliage plants was at its height, this plant was widely distributed. It used to be trained to a trellis for exhibition or grown on the pillars and rafters of hothouses. It is now a rare but choice plant for clothing the tops of unsightly tubs in which palms are growing. G. W. Oliver says it is also excellent for large vases and stands the sun well. The young leaves have a pretty bronze tint unless they are shaded too much. The plant is prop. by cuttings of young shoots taken in early spring. If the tops are pinched the young plants will branch out and make handsome specimens in 4- or 5-in. pots. For potting soil an English gardener recommends compost of two-thirds fibrous peat to one-third of loam, with a liberal sprinkling of silver sand.

Paullinia is a genus of about 80 species, mostly tropical American. Twining shrubs: lvs. alternate, stipulate, compound, 1–3-ternate or pinnate, or decompound; petiole often winged; lfts. usually dentate, dotted or minutely lined: racemes axillary, usually with 2 tendrils: sepals 5, the 2 upper larger, connate: petals 4, but there is a fifth abortive one: stamens 8: ovary 3-celled. Distinguished from allied genera, as Cardiospermum, by the septicidal fr., which is often pear-shaped.

thalictrifòlia, Juss. Lvs. 4–10 in. long, triangular in outline, 3-ternately-pinnate; pinnæ in 6–8 pairs; pinnules 4–8 pairs, 4–8 lines long. Brazil. B.M. 5879. Gn. 51, p. 160. F. 1873, p. 124. Var. **argéntea,** Hort., has foliage suffused silvery gray.



1653. Passiflora cœrulea, the commonest cultivated Passion-flower (× ⅔).

PAULÒWNIA (after Anna Paulowna, princess of the Netherlands). *Scrophulariàceæ*. Ornamental deciduous trees, in habit and foliage similar to Catalpa, with ample, long-petioled, opposite lvs., and pale violet large fls. resembling those of the foxglove in shape, in terminal panicles opening before the lvs. The species in cultivation is fairly hardy in sheltered positions as far north as Mass., but the fl.-buds are usually killed in winter, and it does not flower regularly north of New York city. As an ornamental foliage plant it may be grown as far north as Montreal, where it is killed to the ground every winter, but throws up from the root vigorous shoots attaining 10–14 ft., with lvs. over 1 ft. and occasionally even 2 ft. long. If used as a foliage plant and cut back to the ground every spring, the young shoots should be removed, except one or very few on each plant; during the first years of this treatment they will grow more vigorous every year, but afterwards they will decrease in size, weakened by the continuous cutting back; they should then be replaced by strong young plants. Where the fl.-buds which are formed the previous year are not killed by frost the Paulownia is one of the most conspicuous flowering trees in spring, and in summer the foliage, though it is of somewhat dull color, attracts attention by the size of the lvs. In temperate climates it is sometimes used as an avenue tree. It thrives best in a light deep loam, and in a sheltered position. Prop. by seeds sown in spring or by root-cuttings, and by greenwood cuttings under glass; it may be grown also from leaf-cuttings; the young unfolding lvs. when about 1 in. long are cut off close to the stems and inserted in sand under a hand-glass in the propagating house. Two species in China and Japan; a third one with evergreen foliage is reported by Dr. Henry from South China and pronounced one of the most magnificent flowering trees. Trees with stout spreading branches: fls. in terminal panicles; calyx campanulate, 5-lobed; corolla with long, slightly curved tube, and spreading, oblique 5-lobed limb; stamens 4: fr. a 2-celled capsule, loculicidally dehiscent, with numerous small winged seeds.

1654. Paulownia imperialis.
To show the verdurous growth of the young shoots.

imperiàlis, Sieb. & Zucc. (*P. tomentòsa*, Steud.). Fig. 1654. Tree, to 40 ft., with stout spreading branches forming a round head: lvs. rather long-petioled, broadly cordate-ovate, entire or sometimes 3-lobed, acuminate, pubescent above, tomentose beneath, 5–8 in. long or on vigorous shoots even larger; panicles to 10 in. long: fls. fragrant, pale violet, 1½–2 in. long; pedicels and calyx densely rusty tomentose: capsule woody, broadly ovoid, pointed, 1 in. or somewhat longer. April, May. China, Japan. S.Z. 1:10. B.M. 4666. P.M. 10:7. Gn. 34, p. 79; 54, p. 476. Mn. 7, p. 171. It is sometimes escaped from cult. in the S. States.

ALFRED REHDER.

Paulownia imperialis in southern California reaches a height of 40 ft. in 25 years, with a spread nearly as great. When in full leaf it makes a dense shade. It starts to bloom before the leaves come and all is over before the tree is in full leaf. For this reason it is not a favorite. The Jacaranda is a prettier blue, more floriferous, lasts three times as long, the blooms continuing until the tree is in full leaf. It is out of leaf not more than half as long as Paulownia is. It makes as dense shade as the Paulownia, has a prettier leaf and is more desirable in every way. The growth of the two trees is about the same at the end of a quarter century. The habit of the Paulownia in retaining dry seed-pods on dead limbs 3 or 4 ft. long is very unpleasing, and necessitates a thorough cleaning each year to the tip end of the uppermost branch—often a hard work to accomplish.

ERNEST BRAUNTON.

PAVÉTTA (Malabar name of *P. Indica*). *Rubiàceæ.* About 60 species of tropical shrubs and small trees closely allied to the brilliant Ixoras but far less showy, the fls. smaller, and the clusters looser; also they have a much more conspicuous style, which is often thrust out of the flower an inch or so. The fls. are white or greenish, salver-shaped, 4-lobed (rarely 5-lobed), and borne in trichotomous corymbs, containing as many as 30 fls., which at best may be 1 in. long and ½ in. across. Pavettas generally have membranaceous lvs., while those of Ixora are leathery. In Pavetta the style is longer and spindle-shaped at the top; in Ixora the style generally has 2 short branches at the top. Other generic characters of Pavetta are: calyx-lobes short or long: stamens 4 or 5, barely exerted: disk tumid, fleshy: ovary 2-locular: drupe 2-stoned.

A. *Foliage variegated.*

Borbónica, Hort. Foliage plant with unknown fls. Its position in this genus is a mere guess. Lvs. about 9 in. long, oblong-acuminate, rounded at the base, with a salmon-red midrib, mottled with light green on a dark green ground. Bourbon Island. Lowe 5.

AA. *Foliage not variegated.*

Natalénsis, Sond. Lvs. lanceolate-acuminate, petiolate, glabrous: calyx-teeth bristle-shaped, thrice as long as the calyx-tube: fls. white. Natal.

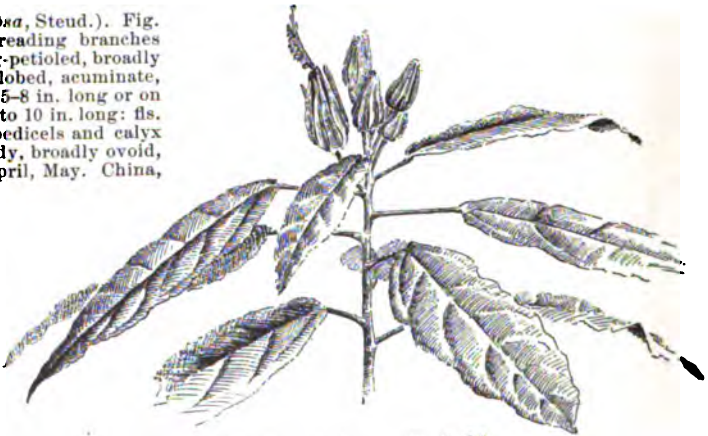
P. Cáffra, Haw. & Sond. Lvs. obovate, almost sessile, glabrous: calyx-teeth twice as long as the tube: fls. white. S. Afr. B.M. 3580.—*P. Indica*, Linn. Glabrons to tomentose: lvs. varying greatly in shape: calyx-teeth much shorter than the tube: fls. white. India. B.R. 3:198.

W. M.

PÀVIA. Included with *Æsculus.*

PAVÒNIA (J. Pavon, joint author of Ruiz and Pavon's Flora Peruviana et Chilensis; died 1844). *Malvàceæ.* About 60 species of tropical herbs or shrubs, tomentose, hispid or glabrescent: lvs. often angled or lobed: fls. of various colors, peduncled or crowded into a sort of head at the tips of the branches: bractlets 5–many, distinct or more or less connate; calyx 5-cut or 5-toothed; petals spreading or convolute-connivent: staminal column truncate below the apex or 5-dentate: ovary 5-loculed, 1-ovuled.

Perhaps the most desirable species is *P. multiflora*, known to gardeners as *P. Wioti*. This has many showy



1655. Pavonia intermedia (× ⅔).

red bractlets, which are linear, erect, hairy, whorled, and nearly 2 in. long. Within the cup-shaped group of bractlets lies a cartridge-shaped mass of dull brown, tightly rolled petals. From the body of petals protrudes the staminal column, which may be 3 in. long and bears numerous violet-blue anthers.

1656. Pea. American Wonder (× 1-5).

The illustration shows an entire plant, cut off at the surface of the ground.

P. Makoyana, Morr., of the trade, is **Gòethea Makoyàna**, Hook , B.M. 6427, a Brazilian plant with a dark purple mass of petals set off by about 5 large, broad, showy red bractlets. The only difference between Pavonia and Gœthea lies in the bractlets, which are narrow in the former and broad in the latter.

P. intermedia, St. Hil., Fig. 1655, is a Brazilian plant int. by the U. S. Dept. of Agric. for economic reasons. Its bractlets are intermediate in breadth between the two genera Pavonia and Gœthea.

multiflòra, A. St. Hil. (*P. Wioti*, E. Morr.). Robust, probably shrubby, usually with a simple stem: lvs. alternate, 6–10 in. x 1½–2 in., obovate-lanceolate, serrulate: fls. in a short, terminal corymb. Brazil. B.M. 6398. F. M. 1877:276.

W. M.

PAWPAW. *Asimina* and *Carica Papaya*.

PEA. The garden Pea is the most important member of the genus Pisum (which see). It is native to Europe, but has been cultivated from before the Christian era for the rich seeds. The field or stock Pea differs little from the garden Pea except in its violet rather than white flowers and its small gray seeds. There are many varieties and several well-marked races of garden Peas. Whilst Peas are grown mostly for their seeds, there is a race in which the thick, soft green pods, with the inclosed seeds, are eaten. The common or shelling Peas may be separated into two classes on the character of the seed itself,—those with smooth seeds and those with wrinkled seeds. The latter are the richer, but they are more likely to decay in wet, cold ground, and therefore are not so well adapted to very early planting. Peas may also be classified as climbing, half-dwarf or showing a tendency to climb and doing best when support is provided, and dwarf or those not requiring support. Again, the varieties may be classified as to season,—early, second-early, and late; examples of these classes are shown in the pictures, 1656, 1657, 1658, respectively. Vilmorin's classification (Les Plantes Potagères) is as follows:

A. The Pea round (smooth).
  B. Plant climbing.
    C. Seed white.
    CC. Seed green.
  BB. Plant half-dwarf.
    C. Seed white.
    CC. Seed green.
  BBB. Plant dwarf.
    C. Seed white.
    CC. Seed green.
AA. The Pea wrinkled (divisions as above).

The Chinese gardeners about New York city grow a Pea which is described as follows by the writer in Bull. 67, Cornell Exp. Sta.: "The Pea (*Ga-lon-ow*) of the Chinese gardens behaves like a little improved or perhaps ancient type of the common Pea. It is the same species as ours. It differs chiefly in having somewhat knotty or constricted pods, as shown in the illustration (Fig. 1659). The pods 'shell' very hard, and there is a tendency to develop a broad border or margin along the lower side. The Peas are small and are variable in color, and they generally turn dark in cooking. In quality they are sweet and excellent, but they do not possess any superiority over our common varieties. The seeds which we have obtained from the New York Chinamen are mixed. In color, the Peas run from nearly white to dark brown. The brown seeds, however, have given us much earlier pickings than the light ones. In one instance the seeds were sorted into three grades—light, medium light, and dark brown—and all were planted in sandy soil on the 20th of April. On the 5th of July the dark-seeded plot gave a good picking, while the light-seeded, and even the medium plots produced much taller plants and very few of the pods had begun to fill. The dark- and medium-seeded plots produced plants with colored flowers—the standard being rose-purple and the keel black-purple and splashed. The light-colored seeds, on the other hand, gave pure white flowers, larger leaves and broader pods. These facts are interesting in connection with the evolution of the garden Pea and its relationship to the red-flowered field Pea."

Left to themselves, the varieties of Peas soon lose their characteristics through variation. They are much influenced by soil and other local conditions. Therefore, many of the varieties are only minor strains of some leading type, and are not distinct enough to be

1657. Pea, Nott Excelsior (× ½).

recognized by printed descriptions. This accounts for the confusion in varieties of Peas, particularly in the dwarf or extra-early types. The varietal names are many. In 1889 (Annals Hort.) American dealers catalogued 154 names. L. H. B.

1. *Peas for the Home Garden.* — Green Peas are at their best when perfectly fresh, and should come to the table within 5 or 6 hours from the vine. Those bought in the market can rarely be served until 24–48 hours after picking, when they necessarily have lost much of their good quality. It is, therefore, a great advantage to have a home-grown supply. Though they are of easy culture, it is not always feasible to give them a place in one's own garden, because they require considerable space, 1–2 yards of row being necessary to produce a single "portion," and it is rare that more than 2 or 3 pickings can be made from the same vines. Peas need a rich, friable soil, but an over-supply of nitrogen or the use of coarse and fresh manure will result in a rank growth of vines, with few pods and Peas of inferior quality. The best manurial condition for Peas is found where a heavy dressing of fertilizer has been applied the previous year. If such a soil is not available, the application of 3–6 bushels of well-rotted stable manure, or, in place of this, about one-half bushel of wood ashes, 3 or 4 pounds of salt and 5–10 pounds of ground bone or other commercial fertilizer to the square rod, and well worked into the surface soil just before planting, will give good results. Most of the cultivation for Peas should be done before they are planted, and it is more important for this crop than for most that the ground should be well worked and made as friable as possible before the seed is sown. While Pea vines will be killed by a hard freeze, they will endure a slight frost with but little injury, and thrive best in a cool, damp soil and atmosphere. It is, therefore, desirable to plant as early in the spring as the soil can be worked. The writer likes best to plant in double rows about 6 inches apart, with the distance between the pairs about equal to the height to which the variety grows. If the soil is sandy and well drained, form a trench 4–6 inches deep and drop 10–20 seeds to the foot according as the variety is a tall- or dwarf-growing one, and cover about an inch deep, gradually filling the trench as the plants grow. In proportion as the soil is heavier and less porous and well-drained the trench should be shallower until, on tenacious clay soils, the seed should be within an inch of the surface.

1658. Pea, Champion of England (× ¼).

All the garden varieties, if planted in the way suggested, will give a fair return without trellising, but those growing over 2 feet high will do better if supported. There is nothing better for this purpose than brush, but this is not always available, and the vines can be well supported by driving stakes 2–4 inches wide 12–20 feet apart in the double rows, and as the vines grow inclosing their tops between wires or wool twine stretched opposite each other on either side of the stakes.

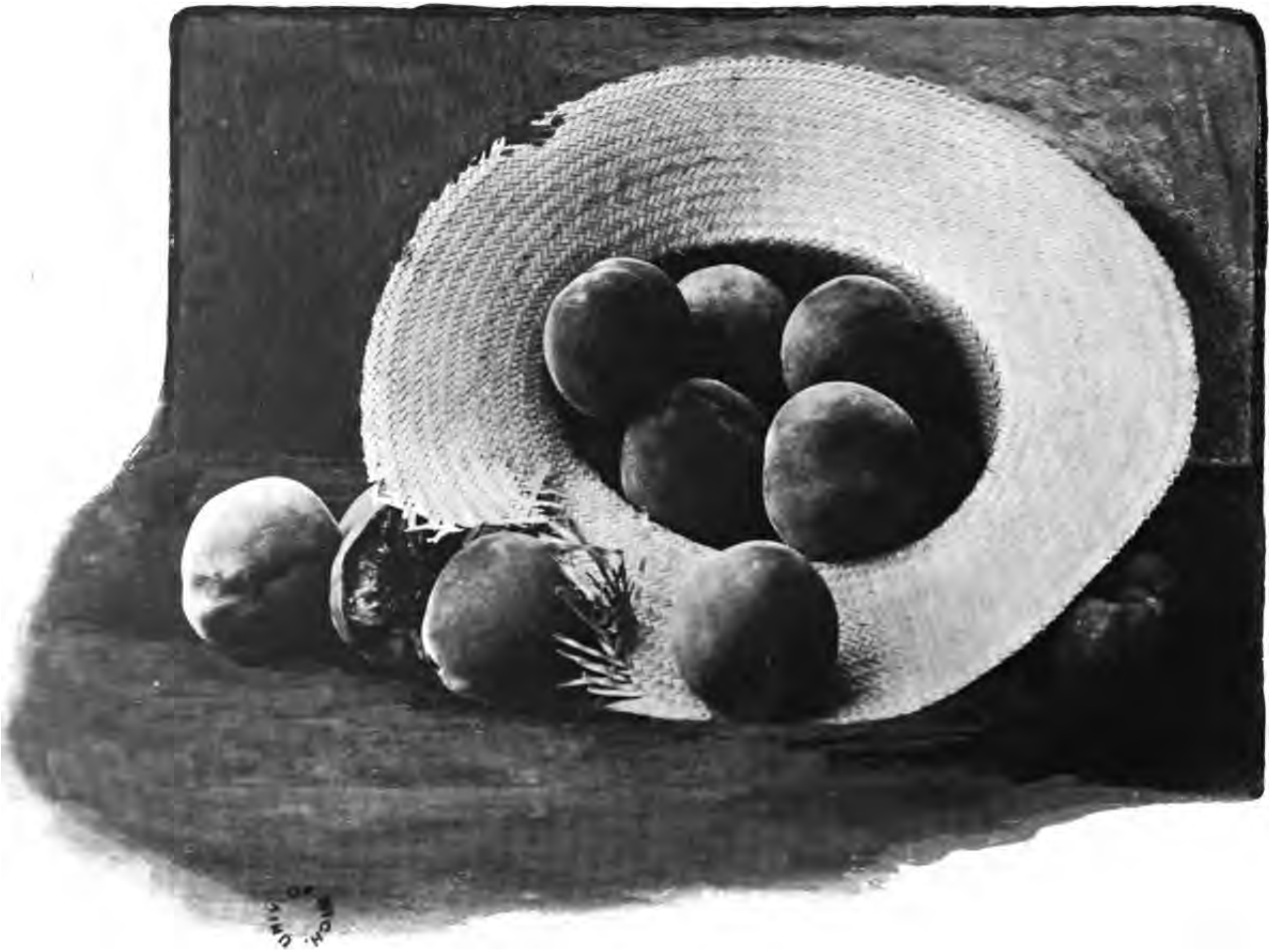
Anything more than mere surface tillage is apt to do the Pea crop more harm than good, but any crust formed after rain should be broken up, and the vines will be greatly benefited by frequent stirring of the surface soil.

2. *Peas for Market.*—The above notes will suggest the best methods of culture for market, and profit will depend largely upon the selection of varieties suited to the needs of the trade, and the use of pure and well-grown seed.

3. *Peas for Canning.*—The quantity of Peas canned, and the popularity of such goods, has been largely increased by the use of the machines known as viners, in the use of which the vines are cut when the green Peas are in the best condition for use, and fed into the machine, which by a system of revolving beaters and cylinders separates the green Peas as effectually as a threshing machine does those which are ripe and dry. As the vines will begin to heat and spoil within a few hours after cutting, it becomes essential to get them through the viner and the Peas into the cans the same day they are gathered, and the canned Peas come to the table fresher and better in quality than from most of the pods obtainable in market. When grown for canning or for seed, Peas are usually sown broadcast or with grain drills and no farther culture given, though the crop is improved by a judicious use of the roller after sowing and a weeding harrow just after the plants are up.

4. *Varieties and the Growing of Seed.*—There are few vegetables in regard to which there is greater difference in tastes as to desirable qualities. To some people tenderness is the most essential quality; to others sweetness, while still others care most for a rich flavor and marrow-like texture. Varieties have been developed to meet all these wants, as well as those varying in growth from 6 inches to 6 feet in height and of great diversity in the size, form and color of the pods. In this vegetable the quality and purity of the seed used is of great importance, for every "mess" of Peas consists of the product of many seeds, and as the pods are so near alike that it is impracticable to separate them in gathering, the product of a single inferior seed may injure the entire picking. Again, Peas grown for seed return a very small fold, very rarely as much as 20 and more often less than 5 times the seed planted; so that it is impracticable for the seedsman to offer his customers seed grown direct from the seed of individually selected plants, as can readily be done in the case of tomato, squash or other vegetables, which give a larger seed return. The most that can be done is to use the greatest pains to keep the varieties pure and of high quality by constantly renewing stocks by selection and the preventing of deterioration or mixing while growing and handling. With none of our common vegetables is the

1659. Pea grown by the Chinese gardeners in the neighborhood of New York City (× ⅓).



UNIV. OF MICH.

Plate XXVI. Peaches of the common Persian race.—The Crosby variety (about one-third natural size).

planter more dependent upon the ability and honesty of his seedsman.

Some of the most distinct types of the hundreds of varieties of garden Peas are:

(1) The earliest kinds, such as Alaska and First and Best, which produce early-maturing, comparatively small pods filled with Peas of rather low quality, on vines about 2 feet high.

(2) A long list of dwarf-growing sorts like American Wonder (Fig. 1656) and Premium Gem, which produce small- or medium-sized pods generally crowded with Peas of fine quality on vines ranging from 6–18 inches in height.

(3) A large class like Strategem and Heroine, which produce very large pods containing large, rich-flavored Peas on thick, heavy vines growing 18–30 inches high.

(4) Lastly, there are the taller growing sorts, like Telephone and Champion of England (Fig. 1658), which yield large crops of large- or medium-sized pods on vines growing from 4–6 feet high.

In addition to the above-named sorts grown exclusively for use as green Peas, there are a number of kinds with hardy, vigorous, tall-growing and usually branched vines which produce in great abundance smooth, hard Peas which are used when ripe for split Peas or other form of "soup stocks" or for stock-feeding; though some of them, like the Marrowfats and the "Turkey" or French Canner, are quite extensively used for canning, most of the celebrated Petit Pois of France being put up from the last-named variety. In field culture for stock the ground should be made ready in the fall and the surface simply "fined" with a cultivator, disk or gang plow in the spring. As early as the surface can be got into good condition sow broadcast, carefully covering with a gang plow or disk harrow, from 1½ to 3 bushels of seed to the acre, according to the variety used; or they can be put in rows better with an ordinary grain drill, provided it be of a pattern with the feed so arranged that it will not crack the Peas, many a poor stand being due to the seed being injured by the drill. It is generally an advantage to roll after sowing, and in some cases a weeding harrow can be used to advantage when the plants are an inch or two high. The crops should be harvested before the vines are so ripe that the Peas will waste by shelling, and it can be done by pea harvesters, which are attachments to ordinary mowing machines, or cut and "rolled" into windrows or bunches with a short scythe. They are easily threshed. The ordinary yield is from 20 to 50 bushels to the acre.

W. W. Tracy.

PEA. **Everlasting P.**, *Lathyrus latifolius*. **Glory P.**, *Clianthus Dampieri*. **Hoary P.**, **Pigeon P.**, *Cajanus Indicus*. **Scurfy P.**, *Psoralea*. **Sweet P.**, *Lathyrus odoratus* and *Sweet Pea*.

PEACH. Plate XXVI. The Peach is essentially a luxury. Its cultivation is attended with much risk. The areas in which it can be grown with success are scattered, particularly in the northern states. The Peach is tender to frost, and the liability of the buds and blossoms to injury constitute the greatest risk in the growing of the fruit. Strangely enough these risks of frost are greater in the South than in the North, because the buds are likely to be swollen by the "warm spells" of the southern winter, and to be killed by sudden freezes. In the northeastern states the Peach areas are determined chiefly by mildness of winter temperature. They lie near large bodies of water, in which places the temperature is considerably ameliorated. In close proximity to the seacoast the winds are usually too strong to allow of the growing of Peaches, but some distance inland and on the margins of the Great Lakes and other interior bodies of water, the fruit may be grown without difficulty. While Peaches are grown over a very large range of country in the United States, still the great commercial regions are relatively few. One of these regions lies in proximity to the southernmost members of the Great Lakes, particularly along the southeastern part of Lake Ontario in New York and Canada, along the southern shore of Lake Erie and on the eastern shore of Lake Michigan. In this latter belt, known as the Michigan "fruit belt," the Peach reaches its highest northern limit in the eastern states, being grown with profit as far north as Grand Traverse, on the 44th parallel. Another large area begins near Long Island Sound, in Connecticut, and follows the seaboard as far south as the southern part of the Chesapeake peninsula and extending approximately one hundred miles inland. In the southern Atlantic states there is another commercial Peach area, comprising the upper lands of Georgia, Alabama and adjacent states. Farther south than this, where the soil does not freeze to the depth of the roots, the root-knot disease, caused by a nematode worm, is so serious as often to interfere with the raising of the crop. In this southern part, also, the old-time varieties of Peaches do not thrive to perfection, but some of the Chinese types are now giving good satisfaction. Another large Peach-growing area lies in southern Illinois, extending westward across Missouri and into Kansas. Eastern Texas has also developed a large commercial peach-growing business. Part of western Colorado is now becoming known as a peach country. Nearly the whole of California, except the mountains, is admirably adapted to the Peach, and the fruit is grown there on a large basis. There are isolated places all over the United States in which Peach growing is profitable, but the above outline designates the areas of largest commercial importance at the present time.

In regions that are too cold for the normal development of the Peach, the tree may be grown with some satisfaction by laying it down in winter. For this purpose the tree is usually trained with a thin or rather flat top so that it will lie upon the ground when the tree is bent over. When the tree is to be laid down, earth is dug away from the roots on one side, the ball of earth which holds the roots is loosened somewhat, and the tree is bent over until it reaches nearly or quite the level of the ground. It may remain in this position without covering, being protected by its proximity to the earth and by the snow which drifts into the top; or sometimes the tree is covered with litter or even with earth,—if with litter, care must be taken that mice do not nest therein and gnaw the trees.

Although the Peach has many forms, it is all one species, *Prunus Persica*. See *Prunus*. It is probably native to China, but it has been in cultivation from the earliest times, and it came into Europe by way of Persia, whence the name *Persica*, and also *Peach*. From this Persian-European source have come the common Peaches of the United States. These Peaches do not thrive well in the extreme south, however. In more recent years introductions have been made directly from China, and these types, of which the Honey (Fig. 1661) is the chief example, thrive well in the far south. Still another type of Peach, which is hardy and productive in the South, is the Indian type sometimes called the "native peach." This is probably derived from the Peaches which the early Spaniards brought into North America. It has run wild over a wide range of country in the South. As early as 1812 the botanist Nuttall found Peaches growing wild as far west as Arkansas. Still another type of Peach is the Peen-to, or the flat Peach of China. This is adapted only to the extreme southern part of the country, thriving well in the northern part of the citrous belt. It is much too early-blooming for even the middle south. It is a very early Peach, much flattened endwise, so that it has the shape of a very flat apple. (Fig. 1660.) It has been described as a distinct species, *Prunus platycarpa*, but there is every reason to believe that it is only a modified form of the ordinary Peach species. Price (Bulletin 39, Texas Experiment Station) divides all Peaches which are known in North America into five general groups: (1) The Peen-to or flat Peach race, comprising the variety known as the Peen-to (Fig. 1660), and also the Angel and Waldo; (2) the South China race, with oval, long-pointed fruit with deep suture near the base, represented by the Honey (Fig. 1661); (3) the Spanish or Indian race, with very late, yellow, firm, often streaked fruit, represented by various southern varieties, as the Cabler (Fig. 1662), Columbia, Galveston, Lulu, Texas and Victoria; (4) the North China race, with large, mostly cling or semi-cling fruit and very large, flat leaves, represented by the Chinese Cling, Elberta (Fig. 1663), Mamie Ross, Smock and Thurber; (5) the Persian race, including the common varieties of the mid-country and the North, as Crawford (Fig. 1664), Oldmixon, Salway, and the like. The varieties of Peaches are many, although less numerous than those of apples. An inventory of 73 catalogues of American nurserymen, in 1900, showed 291 varieties on the market.

The Peach is a showy tree when in bloom. There are double-flowered varieties (Fig. 1665), which are as handsome as the dwarf flowering almond, and they are more showy because of the greater size of the tree. These double-flowered varieties have never become popular, however, owing to risks of winter injury and spring frosts, depredation of borers, and the short season in which they remain in bloom. The flowers of the Peach are naturally variable in both size and color. Peach-growers are aware that there are small-flowered and large-flowered varieties. The character of the flower is as characteristic of the variety as size or color of fruit is. Fig. 1666 shows two extremes. The Crawfords are small-flowered; the Alexander and Amsden are large flowered.

1660. Peen-to Peach (× ½).

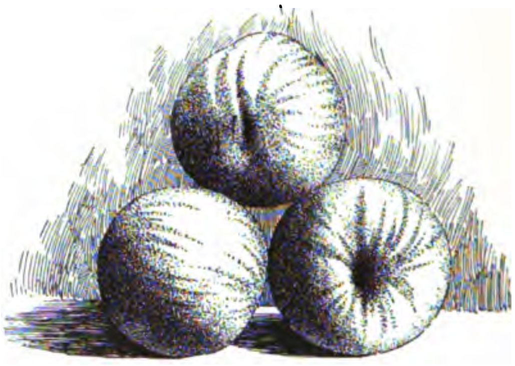
Propagation.—The Peach is always propagated by means of seeds. The first year the seedlings are budded to the desired variety. The seed is planted on the first opening of spring in rows far enough apart to allow of horse tillage, and the seeds are dropped every 6 to 8 inches in the row. These seeds should have been kept moist during the winter. Usually they are piled out of doors, being mixed with sand or gravel, and allowed to freeze. The shells are then soft when planting time arrives and many of the pits will be split. Then it will not be necessary to crack the pits. In the northern states the trees will be ready for budding in August and early September. The buds are set close to the surface of the ground, and they do not start until the following spring. The year succeeding the budding, the bud should make a tree 3 to 6 feet in height, and at the end of that season it is ready for sale; that is, the tree is sold when it is one season from the bud. In the southern states, Peach seedlings may be large enough to bud in June or early July of the year in which the seeds are sown. The buds will then grow that season, and the trees be ready for sale that fall. That is, the whole process is completed within the space of one season. These "June-budded trees" are popular in the South, but they have never become thoroughly established in popular favor in the North. They are very likely to be injured by the first winter, since the trees are not so well matured, as a rule, as the one-year-old trees grown in the North. If, however, they withstand the first winter, they should make as good trees as others. For the details of propagation, see the article on *Graftage* in Vol. II.

1661. Honey Peach (× ¼).

Soil and Planting.—The Peach will thrive on most any soil, providing the climate and site are congenial. The best Peach land, however, is that which is light and sandy. On such lands the Peach develops its highest color and its richest flavor, although on heavier lands it may be more juicy. The soil in the great Peach sections of Michigan and the North Atlantic region is light and loose. On heavy lands the Peach is likely to grow too late in the fall and to make too much wood. The fruit is usually somewhat lower in color and tends to be later in ripening. The low color may be corrected, however, by planting the trees far apart, and by pruning to open tops to admit the sun.

Since the Peach blooms very early and the flowers are liable to be killed by late spring frosts, it is important that the site on which the orchard is planted should either be relatively free from late spring frosts or such as to retard the bloom. In proximity to large bodies of water, late spring frosts are less likely to occur, and the tree blooms relatively late because the water equalizes the climate and adjacent areas do not warm up so quickly in the spring. This is particularly true along such large bodies of water as the Great Lakes. In interior places it is well to choose a northern slope or other backward site, on which place the trees are retarded in bloom. In warm exposures in cities Peaches are very likely to be caught by late spring frosts because they bloom too early. It is usually better in such cases to plant the trees on the north side of a building.

Peach trees are always set when not more than one year from the bud. The distance apart varies with different soils, different parts of the country and with different growers. The standard and maximum distance is twenty feet apart each way. If trees are planted at this distance, they may be tilled with ease, and heading-in may not be necessary. Many growers, however, plant closer than this with excellent results. By giving extra good tillage and fertilizing they force trees to bear young, and by the time the trees begin to crowd the orchard has paid for itself, and some of the trees may be removed. Whilst this practice may be advised in special cases, the case depending on the energy and ability of the owner, it is not to be advised for general purposes.


1662. Cabler Peach (× ½).

Tilling and Fertilizing.—Having selected his land the Peach-grower must look with the greatest care to the cultivation and fertilizing of the orchard. Peach orchards should not be cropped after the third year; and if they are planted on sandy lands, and particularly if set less than 20 feet apart, they should not be cropped from the time they are set. Very frequent stirring of the surface soil from May until August, and thereafter, perhaps, a green crop which shall be plowed under the next spring, is the best general plan of tillage. Never seed down a Peach orchard nor sow it to grain. If there is any fruit that should never be neglected, it is the Peach; and this is why careless men do not succeed with it, and why so many of the orchards produce only debts and discouragement. But it is easy to produce an overgrowth on strong lands. The trees grow to a great size during the first few years, their tops are full of heavy leaves and the foliage holds very late in the fall. These trees generally bear tardily and in some cases they are not productive. They run to wood. The winds tear them to pieces. The trouble lies first in the land:

it is too strong for the Peach. The second trouble may be the too free use of barn manures or other nitrogenous fertilizers, or too late tillage in the fall.

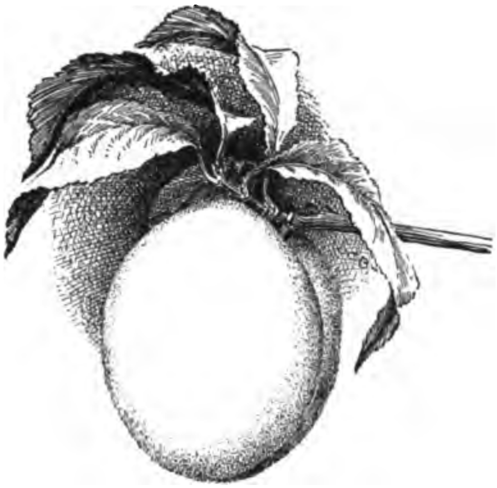
The keynote to the proper fertilizing of Peach orchards is liberal use of potash and phosphoric acid and sparing use of nitrogen. Ashes, muriate of potash, bone fertilizers,—these are some of the best fertilizers for Peach trees. Tillage, with green manure crops at the end of the season, can be relied upon to furnish the nitrogen in most instances; and it is even possible to plow under too much vetch or crimson clover in the course of years. Peaches which overgrow are likely to suffer in winter.

Pruning Peach Trees.—The methods of pruning Peach trees are the occasion of much discussion amongst pomologists. The differences of opinion turn chiefly about three practices,—short trunks with rapidly ascending branches; high trunks with more horizontal branches; and shortening-in or heading-back the annual growth. Each of these three methods has ardent advocates and opponents. It is probable that each system has distinct merits for particular cases. The nature and fertility of the soil are often the dominating factors in these opposing methods. A system of pruning which fits the slow growth and hard wood of sandy soils may not be adapted to the rapid growth and heavier tops of trees on strong soils. Fig. 1667 shows what is believed to be, in general, the best method of pruning Peach trees on sandy or what may be called Peach soils. It is the natural method. The tree is allowed to spread its top at will, with no heading-in. The foliage is comparatively light and does not place great weight upon the branches, and the trees, on such lands, do not grow quickly to such great size as on heavy lands. This method of allowing a tree to make its natural top is the common one in the Chesapeake peninsula (Fig. 1668) and in the Michigan Peach belt (Fig. 1669). It will be observed, also, that the pictures show trees with short trunks and forking branches. It is a prevalent opinion that such trees are more likely to split with loads of fruit than those which have more horizontal branches, but this is an error. Of course, much care should be exercised to see that the branches do not start off from the trunk at exactly the same height, thus making a true fork or Y. With this precaution, the crotchy trees are no more likely to split than the others, while they allow of a much better form of top, unless the tree is to be headed-in. The horizontal branches of the high-topped trees often appear to carry a load of fruit with less ease than the more upright branches of the other style of training. This danger of breaking is greatly lessened if the fruit is properly thinned. The low trunk permits a more open top, and this seems to be an advantage. One is often surprised at the thinness of top in the best Peach orchards of Michigan and Delaware. In such tops, the Peach should color better, and it is reasonable to expect less trouble from fungi.

Yet there is much to be said for the high-topped trees. They are more easy to till and it is quite as easy to pick their fruit; and there is less tendency to make long and sprawling branches as a result of careless pruning. On rich lands, it is perhaps the better method. And here is the chief reason for heading-back in the North,—the necessity of checking the growth and keeping the tree within bounds when it is growing in a strong soil. Whether one shall head-in his trees or not, therefore, must depend on circumstances. In sandy Peach lands it is generally unnecessary, but it may be a good practice when trees make an over-exuberant growth. This heading-in is usually done in the winter, from a third to half the annual growth being removed.

Heading-in the branches always tends to make a thick-topped tree. The best growers usually give much attention to cutting out the small unprofitable wood from the center of the tree (compare Figs. 1670, 1671). This labor may be greatly increased if heading-in is practiced. If not persistently thinned of the inner growths, headed-in trees tend to produce fruits of lighter color and of later ripening. Many orchards have suffered from twig-blight in these central shoots.

The pruning may be made a thinning process. The fruit of the Peach is borne on the wood of the previous year. The Peach makes true flower-buds,—those containing no leaves. Two flower-buds are borne together on either side of a slender leaf-bud. These buds show plainly as early as August, and usually still earlier. At that time they may be distinguished by the triple leaves growing at certain nodes, as in Fig. 1672. When the leaves have fallen, the twin fruit-buds, with the leaf-bud made between, present the appearance shown in Fig. 1673. Not always do the two buds develop: one of them may be aborted or injured so that a single flower-bud and a leaf-bud stand together. These flower-buds are borne on both the strong terminal shoots and on the weak growths in the interior of the tree top. The fruits in the interior of the top are for the most part poor; therefore it is good practice to remove the weak shoots on the inside of the top, thereby thinning the fruit and allowing the energy of the tree to go to the development of the fruit nearer the outside. Any system of pruning, therefore, which removes the annual growth thins the fruit. Heading-back the tree also may be a thinning process. The fruit-buds are borne some distance below the tips of the shoots, however, and unless the heading-in process is somewhat severe, there is little result in thinning the fruit.



1663. Elberta Peach (× nearly ½).

Thinning the Fruit.—There is very general neglect in thinning the fruit. It should be a rule that no two Peaches should stand closer on the same branch than five or six inches. No work of the orchard pays better than this thinning, either in the price which the remaining produce brings in the market or in the vital energy which is saved to the tree. Peach trees that are regularly thinned should bear every year, barring injuries from winter or spring frosts. Growers seem to forget that this fruit must all be picked sooner or later, and that the work is more easily done in June or July than in September. The thinning should be delayed until the fruit is the size of the end of one's thumb, for by this time the "June drop" has occurred, and the

1664. Crawford Peach (× 1-5)

Peaches can be readily seen and handled. The fruit from well-thinned trees usually sells for twice as much as that from overloaded trees, and the vigor of the trees is conserved at the same time; and the grower has the satisfaction of selling a superior product. There are two rules for the workman to observe in the thinning of fruit: (1) removal of injured or inferior fruits; (2) allow no two fruits to stand closer together than the distance which has been decided on—say about six inches for Peaches.

Marketing.—If growers are negligent in thinning the fruit, they are too often positively careless in marketing it. Even in years of low prices, honestly and tastefully packed fruit brings good prices. The handsome boxes of California Peaches, containing 60 wrapped fruits, will sell readily for $2 to $4, whilst home-grown fruit sells for 25 to 75 cents a half bushel; and yet the latter may be the better by the time it reaches the consumer.

There are several faults with common methods of handling Peaches. The packages are too large. The fruit is not graded and selected; in fact, it is not well grown. There are often no wooden covers on the baskets, and, as a consequence, that part of the package which should look the best is usually the most jammed and crushed. In observing the markets, one finds that quite half the packages are not full when they reach the salesman. The Peach is a dessert fruit and should command a fancy price. Therefore, it should be packed in dainty baskets, and the packages should be sold with the fruit. Peaches in bushel baskets is a contradiction of ideals: the bushel package is for apples, potatoes, and turnips.

1665. Bloom of double-flowered Peach (× ⅓).

1666. Bloom of large- and small-flowered Peaches. (× ⅓.)

In New Jersey and Michigan the staple Peach package has been the tall, wide-topped basket. Of late years, however, different forms of the Climax basket (Fig. 1674) have come to be popular, and in some parts of the country they are used exclusively. The fruit always should be packed after it is picked, the best grade being carefully placed in the packages by hand.

Insects.—The two most serious insect enemies of the Peach are the borer and curculio. The borer usually works in the crown of the tree near the surface of the ground. The borer itself is the larva of a wasp-like moth. It is an annual insect, completing its life-cycle within a twelvemonth. The eggs are laid in summer. By October, in most parts of the country, the larva is large enough to be detected. In September or October, therefore, it is well to grub the trees. The earth is removed from the crown with a hoe or strong iron trowel, and whenever a hole is discovered in the bark or gum is exuding, the bark is cut away with a knife until the grub is discovered. Not all the grubs can be detected at any one grubbing. It is well to go over the trees again the following May or June, to catch the large grubs before they pupate. The grubbing of trees may seem like a laborious operation, but it is not expensive if done frequently and thoroughly. It does not compare with pruning in cost or labor. It is the only sure and satisfactory way to avoid injury by borers.

The curculio attacks the fruit. Soon after the blossoms fall the small weevil or beetle, which resembles a pea-bug, lays its eggs in the fruit; and from these eggs a grub soon hatches, and the Peach becomes wormy. The eggs are laid during a considerable period—from two to four weeks—depending on the location and the season. The insect is more or less dormant in the cool of the morning and will drop when the tree is jarred, and this allows the peach-grower a chance of catching it. A large sheet, covering the spread of the top, is laid under the tree and the tree is jarred quickly two or three times, when the curculio falls, and it is then picked from the sheet. There are various apparatus for catching the curculio, all working on the above principle. One of the best of these is a 2-wheeled rig, something like a wheelbarrow, which carries a large canvas or muslin hopper. There is an opening in the hopper opposite the operator, to allow the hopper to be wheeled under the tree so that the trunk may stand near the middle of the machine. When the machine is in place, the operator gives the tree two or three quick thumps, and the insects drop. Usually, there is a tin or zinc receptacle at the apex of the hopper into which insects may be shaken. This bugging operation is begun early in the morning, usually by five o'clock. The first exploration with the bugging-machine is made within a week after the blossoms fall. If insects are found the operation is continued. If the insects are very abundant the bugging will need to be done every morning; but if they are not abundant it may be necessary to go over the plantation only two or three times a week. The bugging is continued as long as the insects are found in sufficient quantity to do much damage. Two or three weeks will usually cover the egg-laying season; but sometimes the catching must be continued even longer than this. This bugging is a laborious operation, but it is the only sure method of combating the curculio. The work can be made much more easy and expeditious if the ground is hard and firm, to allow the machines to be wheeled readily. It is well, therefore, to till the orchard as early as possible, and if the ground is very soft to go over it with a slicker or other compacting implement just before the bugging operation begins. After the curculio catching is done, one may begin the thinning of the fruit. All Peaches which give evidence of having been attacked by the curculio are then picked; this is an important means of keeping the pest in check.

Diseases.—The Peach is subject to many insidious and inexplicable diseases. Of these the worst is yellows. The yellows is a distinct disease. It is not a condition. It attacks Peach trees of all ages and in all conditions of vigor, seeming to have a preference for those that are thrifty. It is incurable, and its termination is always fatal. It is communicable from tree to tree. The means of communication is unknown, but it is not spread through the soil, it probably does not originate in the roots, it is evidently not conveyed from flower to flower, and it is probably not transferred by means of pruning tools. It may be disseminated by buds, even by those from branches that do not yet show signs of the disease. The one unmistakable symptom of yellows is the red-spotted character of the fruit. The flesh is commonly marked by red lines or splashes beneath the spots. These Peaches generally ripen prematurely, and in the second year they are usually smaller and often more fuzzy than the normal fruit. The second symptom to appear—or the first in trees not in fruit—is the "tip" growth (Fig. 1675). This is a short growth starting from the upper or terminal buds, usually late in the season, and is characterized by narrow stiff yellowish small leaves which stand at nearly right angles to the shoot. Sometimes these tips appear late in autumn, after the leaves have fallen, or in spring before normal growth begins. They are often first seen upon the ends of watersprouts. This "tip" growth is sometimes little pronounced, and then only a practiced eye will detect it. The third mark of the disease is the pushing out of slender stiff-leaved yellowish shoots from the body of the tree or the sides of the large limbs (Fig. 1676). In pronounced cases, or when the tree is about to die, these shoots may branch into close bunchy tufts. These symptoms are frequently wholly absent in this state throughout the entire course of the disease.

1667. The Michigan vase-form tree.

In its final stage, the yellows is marked by small and slender growth of all new wood, small, narrow, yellow or reddish foliage, and occasionally by a great profusion of slender and branchy growths in the center of the tree. As a rule, yellows trees die in five or six years from the first visible attack, sometimes sooner. The yellow and stunted condition following neglect or the work of borers—both of the common borer and the pin-hole borer—is often mistaken for yellows. Extermination of all affected trees—root and branch—is the only method of keeping the disease at bay. This work should be done vigorously and thoroughly. The entire community should unite. Trees may be set in the places from which the diseased trees are removed, without fear of contamination. The cause of the disease is wholly unknown. Almost every ascribed cause has been disproved upon careful investigation. Even when the cause shall have been discovered, the remedy will probably remain the same—extermination. The disease has no uniform preference for varieties, soils, climate, nor methods of propagation or cultivation. No fertilization of the soil will cure the disease or check its spread. The disease sometimes attacks the almond, apricot, and Japanese plum. Yellows has been recognized for about a century. It is peculiar to North America, and is generally distributed north of the Carolinas and east of the Mississippi. For more specific information on Peach yellows, consult the writings of E. F. Smith, published by the U. S. Dept. of Agric.

Rosette is a very serious disease of Peach trees in the southern states, characterized by dense rosettes or bunches of foliage on the young shoots. It soon proves fatal. The cause is unknown. The remedy is to exterminate the trees as soon as the disease appears.

1668. Peach trees in Eastern Maryland.

The leaf curl has been the subject of more concern amongst Peach-growers during the past few years than any other disease, except the yellows. It has a decided preference for some varieties, particularly those with large, soft and dark-colored leaves. It is also influenced greatly by the season, although it is rarely wholly absent. A moderate attack does not perceptibly injure trees in full vigor. In many cases, however, the larger part of the leaves fall from the tree in June, and the fruit, deprived of nourishment, may also fall. Leaf curl, the curculio and lack of pollination are the chief causes of the "June drop" of Peaches. The leaves "curl," or become puckered, early in the season, and soon die. Experiments have demonstrated that a thorough spraying with full-strength Bordeaux mixture just before the buds swell in spring is very nearly a specific. If long-continued wet weather follows, it may be advisable to spray again, when the petals have fallen, with Bordeaux mixture, consisting of 2 pounds of copper sulfate, 2 pounds of quick-lime, and 50 gallons of water. If the weather of April and early May is warm and dry, this second spraying will be unnecessary. For full account of Peach curl, see Newton B. Pierce, Bull. 20, Div. Veg. Phys. and Path., U. S. Dept. Agric., 1900 (pp. 204).

"Little Peach" is a recent disease which has appeared in Michigan and western New York. It is ordinarily characterized by the Peaches remaining small and hard, the trees losing vigor and the leaves becoming small. After a time the tree dies. It seems to spread when once established in an orchard. The cause of the difficulty is quite unknown. By some it is thought to be due to a root fungus. Others have associated it with dry seasons, the lack of fertility in the soil, overbearing and other exhausting processes. It has every appearance, however, of being a distinct disease. No remedy is yet known. Growers are advised to pull out the trees and burn them as if they had yellows. Some growers think that they can overcome the disease partially or wholly by liberal applications of nitrogenous fertilizers and by extra attention to tillage. All these questions, however, yet remain to be demonstrated.

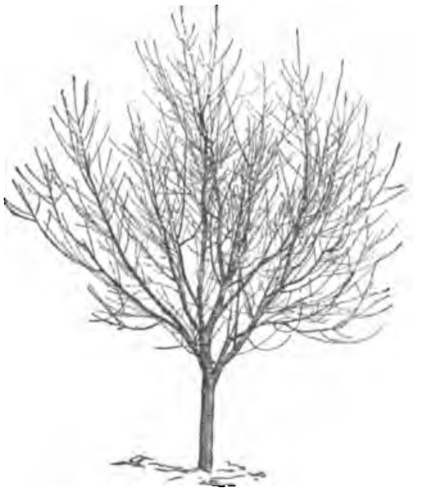
1669. View in a young Michigan Peach orchard.

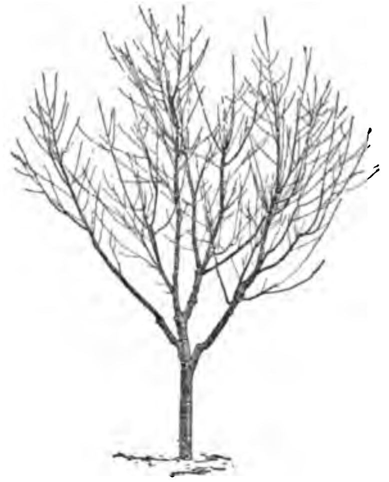
Fruit-rot and twig-blight, due to the fungus *Monilia fructigena*, is a serious disease of Peaches. The rotting of the early Peaches on the tree is too familiar to need description, but it is not generally known that this decay is not a normal process and peculiar to the variety, but is caused by a distinct fungous disorder. Very often these same trees that show the fruit-rot have the young growth blighted, as if attacked by something like pear-blight. This death of the shoots is due to the same fungus that causes the fruit to rot. The decayed Peaches sometimes dry up and hang on the tree, and become a prolific source of infection for the coming year. These mummified Peaches can be found in orchards all over the country, even, in many cases, a year following the attack. They are likely to be most abundant in the center of the top, and the fungus often kills the twigs that bear the diseased fruits. The same fungus attacks the cherry and plum. Prof. F. D. Chester, of the Delaware Experiment Station, found that the fungus sometimes destroys the flowers in spring, and this injury may pass for the effects of frost. He also found that thorough spraying with copper fungicides greatly reduced the injury. His advice for the treatment of the disease is as follows: (1) Gather and burn all mummified fruit. (2) Early in the spring, before the fruit-buds begin to swell, spray the trees with a solution containing 1 pound of copper sulfate to 25 gallons of water. (3) As soon as the fruit-buds begin to swell, spray the trees with Bordeaux mixture or copper carbonate. Follow this by another spraying before the buds open. (4) As soon as the fruit shall have reached full size, make a third application. This may be followed by two or three applications at intervals of five or seven days during the ripening period. It will probably not be often necessary to make more than one late application. Thorough thinning of the fruit is a good preventive of the spread of the rot.

There are no up-to-date American books on the Peach. Three works have been published: Fulton's "Peach Culture," 1870, new edition, 1889; Rutter's "The Culture and Diseases of the Peach," Harrisburg, Pa., 1880; Willcox's "Peach Culture," Bridgeton, N. J., 1886. There are several excellent experiment station bulletins on the Peach. See also, Fitz's "Southern Apple and Peach Culturist," and Black's "Cultivation of the Peach and the Pear on the Delaware and Chesapeake Peninsula."
L. H. B.

Peach Culture in the South (Fig. 1677).—Peaches have been abundant in the southern states since the very earliest settlement, the so-called Spanish varieties being first distributed by the early settlers in Florida, and to this day, all through the South Atlantic states the old "Spanish Blood," or "Tinsley" Peach, is spoken of as one of the choice fruits of the earth. From time to time all the improved varieties were scattered through the South by the more progressive horticulturists and nurserymen, and these and their seedlings were abundant on nearly every plantation. The South being strictly an agricultural country, there was little chance for commercial Peach culture until along between 1870 and 1875, when the introduction of a number of new extra-early varieties of the Alexander type, seedlings of Hale and Rivers, gave such bright, showy Peaches the latter part of May and early June that attempts were made to market them at a profit in our Northern cities.

A lack of quick, through railway-express service caused them to be three and four days on the way, and usually to be delivered in bad order. Occasional lots, arriving in fair to good condition and selling at from $12 to $20 per bushel convinced a few of the shippers that the extra-early Peaches of the South were appreciated at the North, and persistent efforts were continued to get them to market in sound condition. Every conceivable style of shipping package was used,—paper-wrapped fruit placed between layers of cotton, excelsior, paper, etc., and sent by express or steamer,—and all brought about the same returns, "Arrived in bad order." Only occasional lots paid a profit. Finally, heavy refrigerator boxes that would hold about 6 bushels of fruit in packages, and a sufficient quantity of ice, with strong caster wheels under them so they could be trundled in and out of freight cars, were utilized to bring Peaches north by Savannah and Charleston steamers; and by re-icing on the steamers much of the early fruit came through in good order and sold at such satisfactory prices as to encourage the sending of the large midsummer Peaches to market in the same way, and the planting of moderate sized orchards and the further experimenting with seedlings and varieties best suited to long shipments.


1670. Unpruned thick-topped Peach tree.


1671. The interior weak branches are removed. (Compare Fig. 1670.)

The perfection of the refrigerator car for fruit transportation, improved machinery for the cheap manufacture of ice, the consolidation of various small railway lines into great through routes of transportation, and a full appreciation by their managers of the importance of a successful Peach industry, and last but not least, the originating of the Elberta Peach by Mr. Rumph, were the final factors in rapidly developing the great commercial Peach industry in Georgia, and its smaller counterparts in S. C., Ala., Miss., Ark. and Texas.

The year 1889 saw the first large Peach crop successfully harvested and marketed. Profits were large, and being reported in the press many times greater than they really were, stimulated much planting by those entirely unfamiliar with fruit culture, and with no special love for it except the money that might be made out of it. Cheap lands and the abundance of good, low-priced labor were encouragements to extensive plantings. In nearly every state of the South, land in vast tracts suitable for Peach culture may be had at from $3 to $10 per acre, and labor from sun to sun at from 40 to 60 cents per day. Along the Atlantic and Gulf coast, varying from one to two hundred miles inland, most of the land being low and flat, early blooming, followed by spring frost, makes the Peach industry too uncertain to be profitable. The hill lands in western sections of Atlantic coast states, and northern sections of the Gulf states, is really the Peach country of the South. Fort Valley and Marshallville, the great Peach centers of Georgia, though on tablelands about two hundred miles from both ocean and Gulf, and at an elevation of a little over 500 feet, are not in what might strictly be called the hill country, being just below the southern edge of it. In this section of Georgia, most of the Peach orchards have been planted on old cotton-land, much of which has been in cultivation a century or more, and while the surface-soil is worn and poor, down deep in the red clay soil underlying the 6 or 8 inches of sandy, gray loam of the surface, there must be a vast amount of fertility from the way Peach trees grow when once started and a reasonable amount of culture is given.

A majority of the orchardists, who are cotton-planters as well, plant second- and third-class yearling trees, or else small June-budded trees any time from October to March; opening furrows for the trees and cross-checking the rows 18 to 22 feet apart; later plowing this land and planting it in cotton, continuing it for three and often four years. Two to four hundred pounds of low-grade fertilizer is applied in drills for the cotton and usually very thorough culture given; trees are allowed to grow at will, their culture being incidental to the cotton crop. In such orchards very little if any pruning is ever attempted. After the trees become so large as to drive out the cotton, one plowing is given in winter, then anything from fairly good culture to none at all the rest of each season. Such a system results in many "scrub orchards," that are not very profitable after six or seven years.

Specialists, who devote almost their entire time to the Peach business, plant their trees mostly 16 x 16 or 18 x 18 feet and give them entire use of the land. The undersigned, being a rather close pruner, has about 150,000 trees planted 13 x 13 feet and about 175,000 planted 15 x 15 feet.

All land is plowed deep, and sometimes subsoiled before planting. Young orchards are given frequent and thorough tillage up to mid-season, when 2 or 3 rows of cow-peas are drilled in at least 4 feet away from the rows of trees; these and the trees are cultivated frequently, until the peas have taken almost full possession of the ground, and it is time for both the land and trees to have a rest from cultivation. In the fall when peas are ripe, enough are gathered for next year's seed, after which hogs or mules may be turned in to pasture for a time. The stubble furnishes a fine winter cover, and is turned down at first plowing in February or March, when summer culture begins, and at proper time the orchard is again seeded to cow-peas, across the former direction of the rows. Three years of this usually builds up a perfect orchard without the aid of any other fertilizers, except possibly a very little about the trees at time of planting to give them a start.

Low-headed trees are the rule, the trunks seldom branching over 18 inches up, and often 8 inches to a foot from the ground. In one section of the writer's orchard at Fort Valley, Georgia, he has 100,000 trees 8 years old, headed so low that in a full-crop season like 1900, a man sitting on the ground could have gathered fully one-half the fruit from each tree.

1672. The three leaves at a joint, where fruit-buds are forming.

As a rule, the close cutting-back at time of planting, and a general shortening-in of the leading branches for the first 2 or 3 years, is about all the pruning given, even in the best orchards. Our own plan is to shorten-in every year much of the past season's growth, and from the central head often cut back 2 or 3 seasons' growth; but under no circumstances are any of the good side shoots cut out that force themselves on all the main stems when the top is properly headed back. Figs. 1678, 1679. These little side branches have given the writer several full crops of fruit, when without them there has been failure.

Soil and climate favor the very brightest of color on all Peaches in the South; qualities of the soil and the long, hot summer sun give a richness and sweetness of flavor superior to any other section of America, though the same varieties are not as juicy or luscious as when grown further North. The writer's observation leads him to believe that there is more water and less of solid matter in the Peach the further one goes North with its production, and while one can eat more of the northern Peaches ripe from the tree it takes the southern-grown Peach to put fat on one's ribs. During the past ten years, besides very heavy plantings by southern landowners, northern fruit men singly and in corporations have planted extensively of Peaches all through the South, most largely in Georgia to the south and west of Macon, within a radius of 50 miles.

1673. Fruit-buds of the Peach with leaf-bud between.

The orchards in connection with cotton plantations run all the way from 10 to 100 acres in extent, while the "straight-out Peach farm" seldom has as few as 50 acres in fruit, more of them having from 100 to 200 acres, while orchards all the way from 300 to nearly 3,000 acres in extent are no uncommon sight. Samuel H. Rumph, at Marshallville, Georgia, has more than 1,000 acres superbly cultivated in orchard; the writer's orchard at Fort Valley, Georgia, has considerably more than 2,000 acres in fruit trees, 335,000 of which can be seen from an outlook on the central packing house. Rows of trees 1½-2 miles in length stretching away in all directions give a powerful impression of the Georgia Peach industry, which turns out 2,500 to 3,000 car-loads of Peaches in the 6 or 7 weeks of a busy picking season, and yet has not one-half its planted trees in really full fruitage.

Growth usually ceases early in August, and the trees shed their leaves the last of September, a month or 6 weeks before any frosts come. Should the fall be warm and wet, some fruit-buds will be forced into bloom, while the great majority will remain dormant until late January or early February, when spring growth commences. The season of full bloom is usually about the first week in March, though it varies all the way from February 15 to March 25, and no matter whether early or late, the entire blooming season of most varieties covers a period of nearly 3 weeks. While spring frosts are the greatest menace to southern Peach culture, this long blooming period often gives a chance for a setting of fruit between the various frosts, or after the last one, from some belated buds. Even with these varying chances of escaping between frosts, about one year in three Jack Frost is master of the situation, and there is no Peach crop. Two other serious troubles hamper the southern Peach cultivator — curculio and monilia or brown rot. Curculios are very abundant; beginning early in April, they keep up their destructive work until the end of the fruiting season. When the crop is abundant frequent thinning of the stung specimens and burning them prevents serious harm, although the extra expense is considerable; but in seasons of short or moderate crops trees must be jarred daily and the curculio gathered on sheets or canvas trays and destroyed. During the season of 1896, in the Hale orchard, 100,000 trees were freed from the curculio by jarring 50,000 trees every other day for 7 weeks. A practically perfect crop of fruit was harvested, and the orchard shipped more sound fruit than any other 500,000 trees in the state, or nearly one-quarter of Georgia's Peach crop of that year.

The early spring months at the South are inclined to be pleasant and very dry, and the summer rains, which are frequent and abundant when they do come, often do not set in until the latter part of July or early August, near the end of the Peach shipping season. Often, however, they begin in June, and continue for 2 or 3 weeks, and in the case of the season of 1900 it rained for 6 weeks right through the main part of the Peach harvest. Hot sun between showers and the general mugginess of a warm climate rapidly breed the monilia fungus, and brown rot is prevalent on every fruiting tree. Spraying with straight Bordeaux mixture just before the buds swell in the spring, and once or twice more when the fruit is developing with Bordeaux having an excess of lime, is practiced by a few, and holds the rot in check to a considerable extent. Besides the sprays in the Hale orchard, if rot appears, we go over the fruiting trees every day or two, and gather and burn all fruit showing even the smallest speck of rot, and in this way secure much more sound fruit than when only the spraying is practiced. In a majority of orchards, however, neither spraying nor picking the rot is practiced, and the loss of fruit is often from 50 to 80 per cent of the entire crop.

1674. Peach packing. The Climax basket (Michigan).

The first great crop of Georgia Peaches that made a strong impress on all northern markets was in 1889, when the Elberta variety by its large size, great beauty and fine keeping qualities showed up so strongly for the first time as to outclass all other varieties. Great profits were made and, being reported as even greater, there was a mad rush to plant Elberta, and Elberta only. This was kept up until 1896–7 before it came to be realized that there could be too much of even a good thing. The rushing of a great volume of fruit, no matter how choice, into the markets in 2 or 3 weeks, before they had been "toned up" to at least a liberal supply of good fruit, was a business mistake. To remedy this there has been for the past four years a hunt after a good early variety to precede the Elberta, as well as later ones to follow it. So that while prior to 1896 more than 75 per cent of the plantings were of Elberta, since that time not more than 15 to 20 per cent of Elberta have been planted. There is a better balance of varieties, and a longer and more profitable season of marketing has been assured. A few Alexanders are yet planted and open the season late in May. Triumph, ripening a few days later, has been largely planted; it suffered most from rot in 1900, and while of good size and very fine quality, from its "woolly" appearance and early decay, it thoroughly demoralized the early markets; and when the thousands upon thousands of Triumph trees not yet in fruiting come into bearing a demoralization of early southern Peaches is sure to result, that will take several weeks of each Peach season for the markets to recover from, after better varieties begin to come along. Early Rivers, coming to much higher color in the South than in central and northern states, has always been very profitable.

The little Tillotson, that mildews its foliage in the North so as to be a general failure, comes to a perfection of tree and fruitage in the South; the bright red little Peaches, seldom more than an inch and a half in diameter, rich, sweet and delicious, are really the first extra good Peaches to find their way to market. Greensboro a little earlier, and Hieley and Waddell a few days later, are all very large and beautiful early Peaches, that are being extensively planted. Carman, of extra size and great beauty, follows a little later; while St. John, Mountain Rose, Thurber, Belle of Georgia, Elberta and Stump, make up most of the rest of heavy planting; while Emma and Frances are being most largely planted to close up the season from the 1st to the 10th of August. Some Peaches of the Crawford type are grown all through the South, but they do not succeed as well as most others of the Persian strain, and none of the Persians do as well in the far South as the North China strains, to which Waddell, Thurber, Belle and Elberta belong. The South China Peaches, to which the Peen-to, Honey and Angel belong, succeed best in Florida and close along the Gulf coast. While their bitter-sweet flavor is appreciated by some, they are not generally profitable for market.

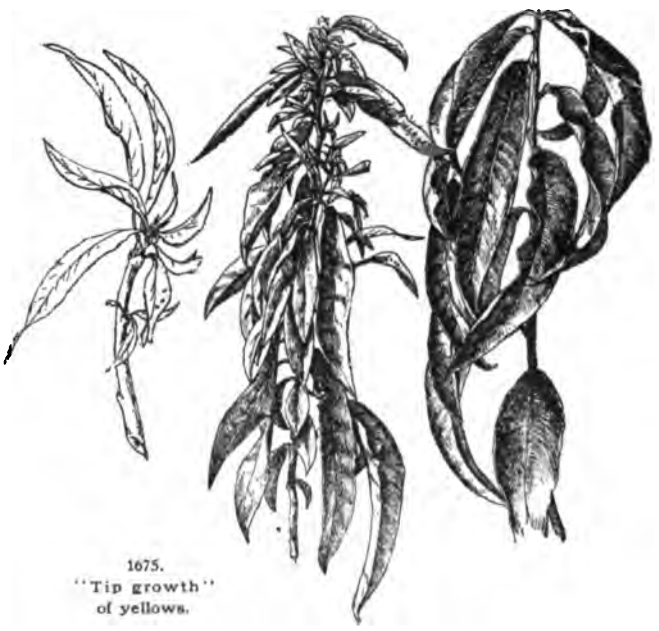
In preparation for marketing the fruit crop, many of the large orchards have railroad side-tracks running to their packing houses in the orchard; refrigerator cars are brought South, and every available bit of side-track for three or four hundred miles about is filled with these cars. At leading centers, refrigerator car people have constructed great ice storage houses, with every convenience for quickly icing and re-icing cars. Agents of these refrigerator car companies, by frequently driving about among the orchards and keeping in touch with the managers, plan to have enough cars iced up and cooled off so as to be ready for each day's demand, and by placing an order with the railroad agent the night before, the orchardist may have one or a dozen refrigerator cars delivered on his side-track in the morning. For smaller shippers, who cannot load in car lots, the railroads keep at all times in season refrigerator cars on siding at each station in the Peach district, into which any number of shippers may load; more often there will be a number of such cars loading at the same time, so that a shipper may have a choice as to which market he will consign his fruit. Except in the height of the season, these cars are often two and sometimes three days in loading, and the continued opening of the car to put in small lots of fruit prevents perfect refrigeration; consequently fruit from small shippers more often goes to market in bad order than from the larger orchards, where a car can be quickly loaded and at once closed up, not to be opened until ready for sale in some northern market. In the Hale orchards a car is often loaded in an hour, and very little of the fruit is ever so long as two hours passing from the tree through the assorting and packing houses to the car. For ten successive mornings, season of 1900, there were picked, graded and nailed up in crates, and the doors closed and sealed up, three car-loads before eight o'clock in the morning; seven o'clock and fifty-four minutes was the latest, and seven thirty-five the earliest finish. Only by a lively start at daylight can such work be accomplished.

In some of the smaller orchards, fruit is packed in crates or baskets right under the trees, and then hauled in open wagons, often without springs, to the railroad station. In others, some of the old farm buildings are used as packing houses; more often special fruit houses are used, their size depending upon the requirements of the orchards, while in style and convenience more depends upon the intelligence of the orchardists and desire to handle the fruit rapidly in best possible manner. The picking basket most generally used is a shallow, round basket, with a drop handle, and holding about a half-bushel. With good refrigerator cars and prompt railroad service, fruit is now allowed to come to full maturity on the tree, and is picked just before it begins to soften.

In the Hale orchard expert pickers instruct all new workers how to judge by the color on the shady side of a Peach, when it is ripe for the harvest; then each picking gang is in charge of a foreman, who is ever on the alert to secure uniformity in the work. Each picker is numbered, and has a little canvas bag with his number stenciled on it, and filled with tickets of same number; one of these tickets is placed in the bottom of each basket as he begins to fill it, so that when any basket reaches the assorting table and proves not to be up to the standard, the inspector of grading is notified, the ticket number given to a field inspector, who on horseback gallops away to tone up the careless picker. Picking 3,000 bushels or more of Peaches in a day, it is possible at any time to locate the picker of every basket. This great orchard is all blocked off by avenues running north and south every 500 feet into about 12-acre tracts, with cross streets every 1,000 feet, so that 250 feet is the greatest distance from any tree to an avenue of travel. Each picking gang has its required number of "basket boys" and "toters," who keep the gang supplied with empty baskets, and "tote" the full baskets to the avenues, where they are loaded on broad, low-down wagons, holding about 80 baskets, and hauled to the packing house, which is a two-story building 40 x 112 feet. The second story is used for storage of crates and baskets, all labeled and finished for immediate use, while the first floor is a platform 3 feet high, sides open all around but protected from sun and rain by a lean-to shed about it, under which the wagons drive as they come from the fields with the fruit.

Two wide packing benches run the entire length of the shed; through the center of these benches, raised nearly a foot, runs a line of canvas trays or pockets, about 18 inches wide, and divided into sections about every 2 feet. Along the outside of these benches, with room enough back of them to receive the fruit from the wagons, stand the graders—bright young men and women from the best white families of the South. There is room enough on the sides of the bench, in front of the canvas trays, for a row of picking baskets, filled with the fruit just as it came from the tree. With one or two expert graders along this line to instruct in the work and consequently keep it toned up, the sound fruit is assorted direct from the picking baskets into three sizes: extras, No. 1's and seconds, all carefully placed in the canvas trays in front. Overripe and bruised fruit goes in baskets at the feet of the grader and finally reaches the evaporator, while the decayed or otherwise worthless fruit goes to the dump and is destroyed by fire. On the opposite side of the bench, facing the graders, stand the packers, with just room enough on the edge of the bench in front of the trays for the 6 basket carriers to stand lengthways (this carrier from long experience having been found to be the one best and most profitable package to handle the southern Peaches). Removing the top layers of baskets and division trays, the bottom tier of baskets is quickly and firmly packed solid full of whatever standard size fruit happens to be in the trays in front of each packer. The division rack and top tier of baskets are then replaced, and filled in the same uniform way. Instructors and inspectors of packing are constantly working up and down the line, encouraging and assisting in the work, so that uniform results may be secured.

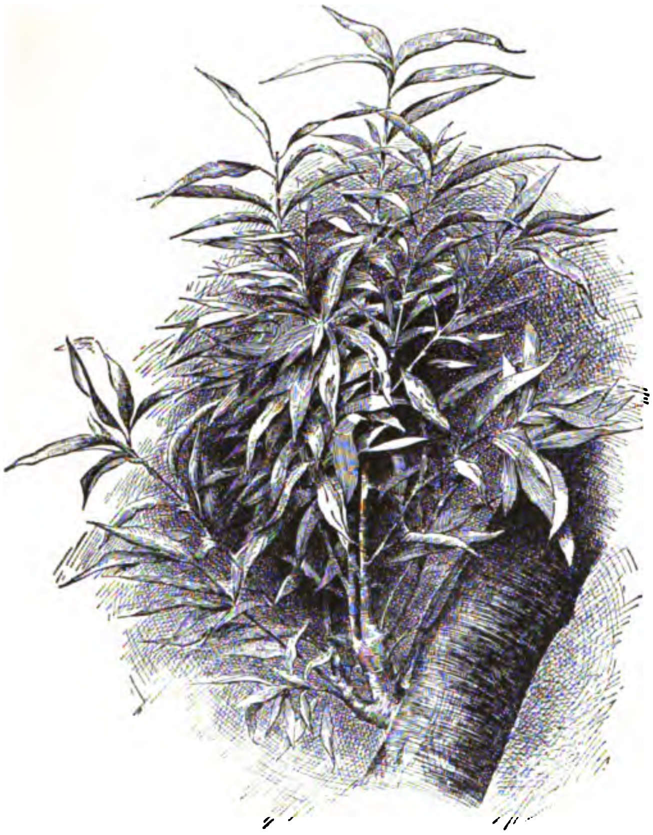
As each package is finished a card with the packer's number is placed on top, and call of "Crate!" promptly brings a "toter," who hurries it to an inspection table, one of which is at each end of the shed. Here an inspector, who is trained to know good Peaches and good packing at sight, either approves it and orders on the cover, or if poorly packed, not full enough, or in any way defective, sends it back to the packer to be righted. Some packers will not put up more than 40 or 50 crates per day, while very expert ones put up as many as 150 and in some cases 200; while the average is from 75 to 80 crates per day when the work is done under the most careful inspection. The name of the variety and grade of fruit is stenciled on the cover, as it is nailed on, and the packer's number is penciled on the red label, on each end of the crate; then away to the car. Here, placed side by side about 2½ inches apart across the car, it takes 7 crates. Then two strips of inch-square stuff, just long enough to reach across the car, are put on top of the crates at each end and are lightly nailed down. Tier upon tier is built up in this way, either 5 or 6 crates high, until the car is full. Spacing of the crates and the slatting provides space for cold air around each and every crate. In dry seasons, when fruit is free from rot germs, cars as now constructed can with safety be loaded 6 crates high, but in wet seasons, with rot prevalent, they arrive in market in much better order when loaded only 5 high. Besides the original icing, which requires 4–6 tons to a car, a re-icing after loading takes 1–3 tons, depending upon how long the car is loading. In going to New York, cars are re-iced at Atlanta, Charlotte, N. C., and Alexandria, Va., and if to New England points again at Jersey City. For Chicago and the Northwest, they are re-iced at Atlanta, Cincinnati or Louisville. A car will hold 525–650 crates, according to the size of the car and whether loaded 5 or 6 crates high. Handled along best modern lines, with careful inspection from start to finish, it costs, including freight and all incidental expenses, from 26 to 28 cents to take Peaches ripe from the tree and place them in the car. Freight averages about 42 cents to the various northern markets, refrigeration 13 cents, cartage 3 cents, and commission 7–10 per cent of gross sales, bringing the actual cost up to about $1 to pick and market a crate of Georgia Peaches, holding six 4-quart baskets. The bulk of the fruit sells at $1 to $1.50, a little sells as high as $2.50 and $3, while considerable is sold at less than a dollar, down to as low as 25 cents; this, of course, for fruit arriving in bad order. Sales at anything above $1 per crate can be counted in towards cost of production and as profit. J. H. HALE.



1675. "Tip growth" of yellows.

Left-hand specimen shows two small-leaved tips appearing in October, 2 or 3 of the normal leaves still remaining near the top. The middle specimen shows numerous tips appearing in August. Right-hand specimen is a healthy twig, for comparison. P. 1231.

PEACH CULTURE IN THE FAR NORTH.—Having tasted Peaches that were thoroughly ripened on the tree, the writer became very desirous of growing this fruit at his home in northern Vermont, and knowing that the fruit buds of the Peach tree are not of sufficient hardiness to endure the rigor of this climate without protection, he exercised himself for some cheap and effective way to cover them. He remembered that when a boy his father had some Peach trees near the house that had been allowed to branch at about a foot from the ground. One winter, in a severe snow storm, a branch of one of them was weighted down by the snow and partly split from the trunk and lay there until spring. Though the thermometer during the storm fell to 30° below zero, that branch bore fruit the next season. Remembering this, the undersigned felt confident that if he could train Peach trees so that the tops could be easily brought down to the ground and covered, he could grow this most delicious fruit. After experimenting some time the following method was found to be efficient.



1676. The tufted shoots of Peach yellows. (See p. 1231.)

Secure a very young tree, preferably a seedling from seed, planted where a tree is desired, and train the trunk of it horizontally 8–10 inches from the ground, and suffer no branches to grow. Break off the tender branches when they are not more than 3 inches long by bending them sideways, not down over the leaf, as that would be likely to break off the leaf also. The trunk is kept horizontal while it is growing by tying it loosely to a slender pole, which is fastened horizontally. Of course the tendency of the tree is to grow upward at the end, and therefore one must look to it about once a week that the branches are broken off and the trunk tied down. When trained in this way the tree will continue to grow vigorously until frost stops it, but it is necessary that the young wood has time to ripen sufficiently to endure the winter. The writer finds that if he ceases to break off the branches for 4–6 weeks before the usual time of frost, the wood at the end of the trunk will be sufficiently ripened to stand the winter when protected.

To protect the tree the first winter, take some half-inch boards about 3 inches wide, and nail their edges together so they will be like a wooden eave-trough. Then cut the tree trunk loose from the pole to which it is tied, put 2 or 3 shovelfuls of earth around the roots and place some evergreens on the ground under the trunk (just enough to keep it from the soil); lay the tree upon the evergreens and place the trough over the tree, covering it completely from root to tip. Finally place a few evergreen boughs over the whole. If the butts of the boughs are thrust a little into the ground they will be frozen in and held firmly.

In the spring when danger from frost is past uncover the tree, fasten the little pole in its place, tie the tree to it and place the trough over the whole of the tree, except a little of the tip. This is important, for if this horizontal trunk, which now has no leaves, is not covered from the sun the bark will surely be killed along its top. After the buds at the tip have grown a little, break off all but the strongest, and train as in the previous year and so continue until the desired length of trunk is obtained. If the tree is in good soil and well cultivated it will in 2 or 3 years make a trunk 10–15 feet long. When this latter length is attained the trunk is long enough to be pliable for a good many years, as its thickness does not increase very fast. Now, while keeping the horizontal trunk in its place, allow its end to grow up and form a head, which may be trained in a fan-shaped fashion, parallel with the trunk. A stout stake is driven at the place where the head is formed, to which it is tied during the growing season. When freezing weather comes the head is loosened from the stake and turned over sideways on some evergreens placed to keep it off the soil. Over the head of the tree put a few more evergreens and over these some boards to keep snow from sifting in, which will melt during a mild time, and later form ice about the twigs and kill them.

From this time the treatment of the tree is the same as that of any fruit tree, except that it must be covered each fall and tied up each spring. The writer was warned that he would be troubled with mice under the coverings, but he has practiced plowing between the trees each fall, turning the furrows toward the trees, and has not been troubled with the rodents. Trees treated in this way never fail to bear and produce as abundantly as when grown upright from the start.

J. T. Macomber.

The Michigan Peach Industry.—The history of commercial Peach-growing in Michigan would be a fascinating tale indeed if it could be written in detail. The eras of prosperity bringing on in many cases the wildest speculation in property, followed sometimes by severe depressions, have given our prominent Peach centers some of the features of a western mining camp. Frequently some shrewd painstaking grower rises to affluence with a few crops from a well-grown orchard, on a wisely selected location, and there immediately follows a class of men who take money out of other lines and plunge into the mysteries of Peach-growing with the recklessness of a gambler, often purchasing most unsuitable locations, planting large quantities of ill-chosen varieties, cultivating them for a few years, only to learn in the end that Peach-growing is a profession, and the production of large quantities of luscious, beautiful fruit, and getting them to market at their highest stage of excellence, is no mean art.

The so-called Peach belt of Michigan is a strip of country located on the east shore of Lake Michigan, varying in width from five to ten miles. In three or four locations, owing to the favorable contour of the lake and topography of the land, Peaches are grown with a marked degree of success, even as far as forty miles inland. This belt begins probably fifteen miles south of St. Joseph, in Berrien county, and extends northward to the northern shores of Traverse bay, Leelanaw county, a distance of some 190 miles; but not all of this belt is successful even though near the lake, it being a notable fact that the most successful regions are where the land line extends nearest the center of the lake, while it is noticeable that where the lake is broadest, extending into the land, the least success is attained.

The wonderful success of this region can be accounted for by just two conditions, a suitable soil and the thermal influence of Lake Michigan. The combination is so good that this region has not seen an entire failure of the crop in thirty years, and very few light crops. Usually there are three to five heavy crops to one light one where orchards are properly located and correctly handled.

The history of the industry can probably be dated to some year prior to 1860, but it did not reach any prominence until about 1864 and was at high tide by 1867. At this time and up to this date the commercial orchards were in a small radius around St. Joseph and Benton Harbor, the sales being almost entirely made in Chicago, as there were no railroad communications with other cities and the steamboat service to Chicago was fairly good. During the year 1867 yellows was first noticed by men who knew the disease, although it no doubt existed here a year or two previous. However, little attention was paid to this disease until it gained such impetus and virulence that these orchards, valued at and selling as high as $1,000 per acre, were swept out of existence. So thoroughly did this disease do its work that there were probably not as many as ten live Peach trees in a whole township in 1880. The pioneers of the Peach industry gave up in despair and either left the country or turned their attention to farm crops or small fruits, which latter industry soon gave this port, Benton Harbor, the distinction of being the heaviest shipping point for small fruit in the United States.

While this destruction of the orchards was going on at this point a few men at South Haven, 30 miles north on the high banks of Lake Michigan, with perfect soil and slopes and most beautiful surroundings, had begun the planting of orchards, and with wisdom born of misfortunes and with a higher intelligence, began to investigate the dread disease; and so well and correctly did they learn its treatment that to this day the yellows has never gotten the start of them and the orchards were never better nor larger than they are today, while the yellows had been constantly with them since 1875. In sharp contrast to this case, another point within 30 miles began setting Peaches about 1880, nearly the entire country being covered with beautiful orchards for miles around, but when the yellows appeared many owners, with strange perversity, refused to destroy diseased trees or allow it to be done under the law then recently enacted for the purpose of protecting orchards from destruction by this or other contagious disease. They even went into the courts to save dying trees from the ax and fire of the legal commissioners. The inevitable result was that in a few years this beautiful prosperous region was practically out of the Peach business.

During these years it had been discovered that Peaches could be grown with success and profit at points far north, and in some cases far inland, where the elevation was great, until now immense quantities are marketed in Kent, Oceana, Mason, Benzie, Grand Traverse and Leelanaw counties, while Berrien is rapidly regaining her lost prestige as the heavy producing county, an honor long held by Allegan county.

In all these counties the yellows now exists in nearly all orchards over four years old, but only in the hands of a careless few is it allowed to gain enough headway to menace an orchard. All men now know that as soon as the disease appears the tree affected should be destroyed by fire as commanded by law, and if neglected the entire orchard must pay the penalty. Commissioners clothed with power to act stand guard over the careless ones in every township, compelling them to destroy immediately all affected trees or do it themselves, charging up all cost and collecting it with other taxes. So well does this law work and so few are our other difficulties that this Peach belt is now beyond doubt the best in America, the crops being more profitable than those of California and more reliable than those of any other section.

It is impossible at this date to give statistics as to the acreage of yield, as the business is extending so very rapidly and the census report of 1900 is not yet issued. In a general way it may be said that this entire region is one of small orchards. Nothing like the mammoth orchards of Georgia can be found in the state, but orchards can be found in every neighborhood producing more Peaches from one acre than these mammoth orchards do from four, and giving regular annual crops. Trees well cared for usually begin producing at two years old, and at four years old should and do produce 4 to 5 bushels per tree, while the best orchards sometimes produce as high as 8 or 10 bushels on trees 6 to 8 years old and with trees set 20 by 20 ft., which is common practice, the yield varies from 200 to 800 bushels per acre.

The cultivation and care of the Peach orchard have undergone great change in the past 10 years. What might be styled modern methods prevail now in nearly every neighborhood; fine and thorough tillage, careful timely pruning and rigid thinning previous to the pit-hardening period are the rule among our best growers. They know that a tree overloaded cannot produce choice fruit nor can a tree weakened by an excessive crop of fruit produce a good crop the following year.

The best fertilization for our soils for Peach-growing seems to be phosphoric acid in the form of bone, and potash in the form of carbonate or muriate, with vegetable mold furnished every year by a growth of oats or other winter cover-crop sown after tillage ceases in August. This cover-crop holds all the Peach foliage where it falls. In the spring it furnishes a decomposed mass ready to be turned under to a shallow depth by gang plows.

The packages used are of various kinds, but the principal ones are the one-fifth bushel or 10-pound basket, the ½-bushel or 25-pound basket and the bushel basket for medium grades, while the 6-basket carrier crate, holding 30 pounds of fruit, is a favorite package for strictly fancy grades.

The markets, as well as the market facilities, are unsurpassed. With only 3–6 hours' run the lake steamers land the freshly picked fruit in Chicago or Milwaukee, where sales are made during the earlier morning hours, and shipment made by refrigerator trains and express for all the cities of the great west and northwest region where Peaches cannot grow. In this manner is the supply for the smaller cities distributed, while the larger cities are supplied by refrigerator cars loaded where the fruit is grown and sold to spot buyers or consigned to the commission trade. In addition to this five or six great railway systems take solid trains of refrigerators out of this region every evening on rapid schedules for points east and south, the favorite markets being Buffalo, Pittsburg, New York and Boston in the east, Indianapolis and Cincinnati in the south, while there has sprung up during the past two years a very large direct car-load trade with cities in Iowa and Missouri river points.

The profits of this crop vary so much according to the skill and judgment of the grower that it is well-nigh impossible to give accurate information, but it is probably a safe estimate to put the average net profit at $100 to $150 per acre for a term of years with ordinary care, but the best growers realize far greater returns. Indeed, in 1899, when all other regions except California had an entire failure, the region about Benton Harbor and St. Joseph had a fair crop and net returns of $300 to $500 per acre were common, while in one orchard over $35,000 was taken from 40 acres, and one block of four acres of Elbertas gave a return of $6,700, or $1,675 per acre, following with a crop in 1900 that gave a net return of more than $600 per acre in a year of great plenty and low prices. Such yields and prices are phenomenal, and should only be considered as indicating the possibilities of the crop under most favorable circumstances and with skilful management.

Several attempts at organization for commercial purposes have been attempted, but so far none have been entirely successful unless what is known as the central packing-house system now being worked at two points in the Peach belt may be said to be a success. This plan is one by which several growers combine and build a packing house on the railroad, hauling all their fruit to this central point, where it is all packed under the supervision of a superintendent and loaded directly into the cars, selling in car lots by grade either to spot buyers or in distant markets by wire so far as possible, consigning the balance to promising markets. This plan has the advantage of relieving the grower of the burden of operating a packing house, thereby reducing cost of packages and packing to a minimum and facilitating sales. The disadvantage is in hauling loose Peaches several miles, and in the extra handling, which causes bruising and injury to quality if fruit is ripe. This last fact necessitates picking the fruit rather green and makes it unsatisfactory to the best trade, so that it becomes an open question as to the desirability of the plan. It is noticeable, however, that the largest and best growers almost invariably pack and ship their own product, believing that there is greater profit in a high individual reputation than in combination.

In another manner has the State Horticultural Society and an excellent system of State Farmers Institutes worked a vast benefit to the industry. They have held meetings singly and in series in every Peach-growing locality in the state. At these meetings every detail of modern high-class Peach culture and marketing has been freely given by the most successful growers of this and other states. These meetings have been followed by complete printed reports placed in the hands of every grower. In this connection it should not be considered too extreme to state that the help received by our growers from a few able practical and scientific men cannot be estimated in dollars. Suffice it to say that nearly every practicable idea given by these men has been quite generally acted upon with great financial advantage, and the improvement in handling this crop has been so marked during the past five years as to be really phenomenal. Nature having done its full duty to this region, the elements required for success are a careful selection of location with regard to soil, elevation and shipping facilities, a willingness to learn, and a love for the business, coupled with a high sense of honor in marketing. The adverse conditions are improper selections of location or varieties and the diseases, yellows and curl leaf, both of which are quite easily managed by energetic men. Trees affected with yellows are promptly removed and destroyed, and replaced immediately by young trees. The curl leaf is not regular in its appearance, but occasionally a season comes when its attacks on certain varieties are serious. It is easily controlled by preventive spraying.

The writer has visited many of the noted Peach regions, but nowhere has he ever seen such success attained by men of modest means as in the Michigan Peach belt. Its future looks even brighter than its past.

R. MORRILL.

PEACH CULTURE IN DELAWARE. — 1. *Historical Sketch.*—No one knows when the first Peach trees were planted in Delaware, but undoubtedly there were many before the Revolutionary period. The trees were seedlings, and every old garden contained a sufficient number to supply the family with preserved and dried Peaches during the winter months. There was also a surplus, which the "lord of the manor" had distilled into Peach brandy, in which all gentlemen of the old school delighted. We read that as early as 1814, a Mr. Bayley, of Accomack county, Va. (a county south of Delaware on the peninsula), had 63,000 Peach trees, the product of which was converted into brandy. The trees at 6 years of age yielded about 15 gallons of fourth-class brandy per 100 trees, which sold at $2 per gallon. The profits could not have been large, unless the trees were planted much closer than they are now planted. It is possible that the seed was sown in rows, and the seedlings allowed to remain as they grew.

The first Peach orchard for commercial purposes in Delaware was planted in the spring of 1832, by Isaac Reeves and Jacob Ridgeway on a farm belonging to the latter, about one mile from Delaware City, on the Delaware and Chesapeake canal. It consisted of 20 acres of budded trees, and by 1836 they had planted 110 acres. In a single season Messrs. Reeves and Ridgeway received $16,000 gross from their Peach crop, the fruit then bringing from $1.25 to $3 per 3-peck basket in the Philadelphia market. This success induced others to embark in the business, among whom was Major Philip Reybold, who in 1842 had 12,960 trees. James Thompson was another pioneer in the business. In 1846 he stated that New Castle county contained about 3,000 acres in Peach trees. Major Reybold and his sons alone had 117,720 trees covering 1,090 acres, from which 63,344 baskets were shipped in August of 1845. In 1848, the Peach crop was estimated at 500,000 baskets, chiefly from New Castle county, of which the Reybolds grew about one-fourth. In Kent county, Jehu Reed had planted an orchard of Red Cheek Melocoton as early, perhaps, as 1829, and several years later had 10,000 trees. J. G. Brown in the seventies had one of the most extensive orchards in Kent county. In Sussex county, Capt. Chas. Wright was one of the first to plant trees on an extended scale, and in the sixties sold the product of a 10-acre orchard for $5,000 net. The varieties were Troth, Early York, Golden Rareripe, Oldmixon Free, Stump, Crawford Late, Mammoth Melocoton, Crockett White and Smock. Ex-Governor Ross and J. P. Collins were also extensively engaged in the Peach business, but the orchards in Sussex at that time generally consisted of from 1,000 to 5,000 trees each.

Governor B. T. Biggs, Governor John P. Cochran and J. B. Fennimore were among the largest growers around Middletown in 1871, and Seerick Shallcross, also of Middletown, marketed 125,000 baskets, valued at $150,000. This orchard contained more than 100,000 trees, and was said at that time to be the largest in the world.

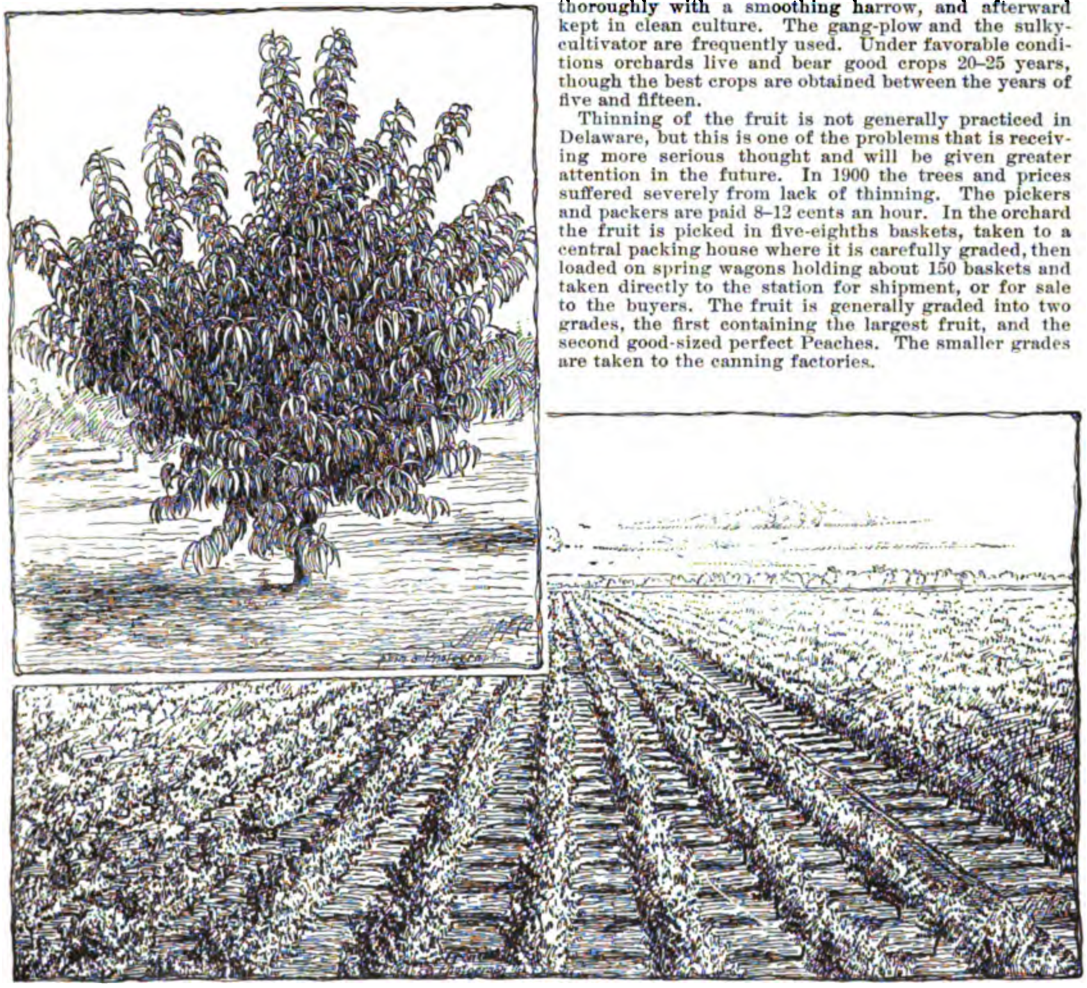
Delaware was the first state to develop Peach culture on a large scale, and for years produced more fine Peaches than any other locality in the world. The quality, appearance and size of the fruit when grown under favorable conditions have never been excelled, if equaled, by any other section of the United States, but the appearance of the yellows in New Castle and Kent counties, the frequent destruction of the crop by untimely frosts, and the opening of other sections has taken some of the glory away from the once famous Peach districts of Kent and New Castle counties. The center of the industry was Middletown in the late sixties. Then it moved to Smyrna. After a few years Wyoming was the great Mecca towards which all the commission men looked for their supply; now it is Bridgeville. The Peach belt has been moving southward for several years, until now Sussex county raises the largest part of the crop. The trees do not attain the mammoth size of those on the heavier soils of New Castle and Kent counties, but Sussex, except in northern parts, has escaped that bugbear of Peach-growers, the "yellows."

There are probably about four million Peach trees in Delaware, though no accurate statistics have been made since 1890. The Delaware railroad company estimated that there would be 4,500,000 baskets of fruit along its various lines in 1900, but its records for the crop are not yet completed. On August 25, 35 car-loads, mostly of yellow fruit, were shipped from Bridgeville alone. There would have been at least 60 cars had there been a demand for white fruit, but a large proportion of the white Peaches were not picked in 1900. The Peaches are shipped to all of the large cities where freight rates are not prohibitive, and to smaller interior cities of Pennsylvania, New York and New England.

2. *Culture.* — Most of the trees are set in the fall. Where fall planting is practiced the tree pushes out young roots all winter during mild weather, and as a rule grows better than when set in the spring and is compelled to grow roots and leaves at the same time. The ground, preferably a clover sod, high and dry, is plowed deep, thoroughly harrowed and checked into rows generally 20 x 20 feet apart. Some planters set 22 feet, others closer. A hole is dug of sufficient size to admit the roots without crowding, and in November the tree is planted about the depth it formerly stood in the nursery, with soil heaped a little to allow for settling. For planting, the writer prefers a good one-year tree of the second or third grade, 2–3 feet in length, without many branches. The small nursery stock will make good trees if properly cared for and will last as long, bear as much fruit and come into bearing as young as trees 4–6 feet high. It is a great mistake to suppose the larger tree is better. It is more sightly, but that is its chief merit. It will not develop as many roots, nor will it pack in as good shape for shipping, and the shock of transplanting is far less to the small tree; it can be cut back root and top; it is much easier to plant; and the percentage of loss is much smaller, for if in good condition and well planted, 99 per cent will grow. The undersigned says this after having grown several million trees in the nursery and many thousand in the orchard of his own propagation and from other nurseries all over this country. On light lands a shovelful of wood ashes or of well-rotted manure gives the tree a good start. Either is applied at the base of the tree during the winter. Before the sap starts the trees are usuall

headed-back to a whip 18–24 inches high, and all young shoots are afterwards rubbed off except 4 or 5 for the top. Young orchards are usually well cultivated until from August 1 to 15. Aphids, if they attack the top, are destroyed by strong tobacco water or kerosene emulsion. If the aphids attack the roots a handful of good tobacco dust applied, after removing the surface soil, will generally kill them. Orchards are cultivated in corn, potatoes, tomatoes, etc., or any other hoed crop until they come into bearing at 3–5 years; after this they should have the entire ground, with no other crop except crimson clover or cow-peas for humus in years when there is no fruit. Corn is not as desirable as some low-growing, cultivated crop, like potatoes or tomatoes, which can be manured highly and at the same time not interfere with the trees. Under no condition should the trees be seeded in grain or grass, and clean cultivation should be given each year. The trees are usually examined for borers at least once a year and sometimes twice.

The pruning is done in fall or winter. No heading-back of bearing trees is practiced, but no doubt many of the young orchards now being planted will be grown in this manner. Dead wood is removed annually and the top kept open to admit the sun so as to color the fruit. A low wagon is often used for hauling out the brush.



1677. Peach growing in Georgia. View in the Hale orchards, Fort Valley. (See p. 1232.)

Dissolved South Carolina rock and muriate of potash makes one of the best fertilizers. Raw bone is more expensive, and it is doubtful if it is better than South Carolina rock. From 600–1,000 lbs. may be applied per acre broadcast in the winter or early spring. Wood ashes are good but hard to obtain. Bearing orchards are generally plowed in April, 3–4 inches deep, harrowed thoroughly with a smoothing harrow, and afterward kept in clean culture. The gang-plow and the sulky-cultivator are frequently used. Under favorable conditions orchards live and bear good crops 20–25 years, though the best crops are obtained between the years of five and fifteen.

Thinning of the fruit is not generally practiced in Delaware, but this is one of the problems that is receiving more serious thought and will be given greater attention in the future. In 1900 the trees and prices suffered severely from lack of thinning. The pickers and packers are paid 8–12 cents an hour. In the orchard the fruit is picked in five-eighths baskets, taken to a central packing house where it is carefully graded, then loaded on spring wagons holding about 150 baskets and taken directly to the station for shipment, or for sale to the buyers. The fruit is generally graded into two grades, the first containing the largest fruit, and the second good-sized perfect Peaches. The smaller grades are taken to the canning factories.

In the nursery the trees are always propagated by budding. At one time it was supposed that natural seeds produced the best and healthiest trees, but experience has shown that no trees are better or healthier than those grown from seed taken from the most vigorous orchards.

3. *Marketing.*—Formerly all of the fruit was picked in baskets, packed in crates holding three pecks, and shipped to the commission men of the various markets. At the present time a very large proportion of the crop is sold in five-eighths baskets to the buyers at the railroad station. This method of marketing is the most satisfactory way to dispose of a Peach crop. The buyers generally pay cash, and the grower with the money in his pocket is relieved of all the worry connected with freights, commission men, and the like. Some of the finest fruit is packed in carriers holding 6 baskets, and is sold at fancy prices, either at the station or in the general market. Refrigerator cars, holding 600 to 800 baskets, are used for fruit that requires two days to

reach its destination and plain cars for near-by points. The cost per basket on refrigerator cars to Boston, Providence, Hartford, and other eastern points is about 40 cents, and to New York, Elmira or Syracuse about 35 cents each. In plain cars the cost to New York is 19 cents, and to Philadelphia about 12 cents each.

A large proportion of the smaller fruit is used by canning factories, of which there are one or two in every town. A factory in Seaford uses about 3,000 baskets per day when running its full capacity. The Peaches are peeled by women, and the factories of the state employ several thousand hands. Formerly a good many of the smaller Peaches were evaporated, and evaporators were built throughout the Peach-growing belt. The present low price of evaporated fruit and the competition of California and the West have caused this phase of the Peach business to be abandoned. Numerous factories have converted large forests of gum and of pine trees into carriers and baskets. In 1900 the baskets cost from 3 to 3½ cents and carriers from 14 to 17 cents each.

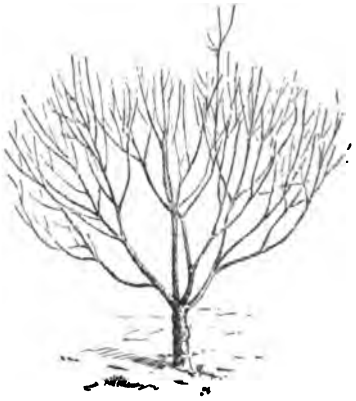
1678. Hale Peach tree before pruning. (See p. 1233.)

4. *Varieties.*—In no other fruit have the standard orchard varieties changed more than in the Peach. Many of the Delaware orchards planted not more than ten years ago are now unprofitable because varieties in demand then are now out of date. Formerly the white Peaches, such as Oldmixon and Mountain Rareripe, were in strong demand; now the call is for yellow fruit, and the finest white varieties have to be sold at low prices. Early kinds also used to pay, but now they come in competition with the best varieties from Georgia. Late varieties, which were also very profitable, are now ripe when the best fruit from New York, New Jersey and western Maryland is in the market. The old orchards comprise Troth, Hale, Crawford Early, Mountain Rose, Reeve, Oldmixon, Mt. Rareripe, Crawford Late, Stump, Smock, Couper Late, Garey Hold-on, and others, and as in other fruits, most of them contain too many kinds. A large proportion of these old kinds have to go to the canning factories at low prices whenever there is a general Peach crop, as the market will not take them. In the new orchards the yellow fruit will predominate, with a few white varieties. Probably the kinds most often found in orchards under five years old are Foster, Mountain Rose, Reeves, Oldmixon, Moore Favorite, Elberta, Chair Choice, Crawford Late and Smock. The Elberta is being planted more heavily than any other variety. If the writer were to set a new orchard his own choice would be as follows: Connett Early, perhaps Mountain Rose, Foster, Reeves, Elberta, Chair, perhaps Crawford Late, Prize and Townsend. Nearly all growers would always include Crawford Late, and many of them Moore Favorite and Thurber.

Of the newer varieties in Delaware, Connett Early, Carman, Waddell, Greensboro, Champion, Mamie Ross and Lady Ingold are the most promising, with preference for the first three and the fifth and sixth. The Delaware Experiment Station has an experimental orchard of 300 varieties ten years old at Seaford, on the writer's place, and another orchard of 75 varieties at Bridgeville, most of which fruited in 1900. In the Seaford orchard a number of Tasmanian trees were planted to determine their orchard value and their susceptibility to Peach yellows. A number were also planted at the Delaware Experiment Station grounds and in other parts of New Castle county. In Sussex county they are vastly inferior to home-grown stock in the quality of the fruit and in the growth of the trees, while in New Castle county they practically all died from the yellows.

5. *Peach Yellows.*—The yellows swept the orchards out of New Castle county and from the northern part of Kent county, but it has not advanced for ten years much beyond the borders of northern Sussex. The most intelligent growers hold it in check by cutting out the trees on the first indication of disease and burning them, but there is no systematic attempt on the part of all growers, nor on the part of the state, to stamp out the trouble. There is a yellows law on the statutes, but it is not enforced, though in the past its enforcement did much good. For several years the disease has not been so severe, though there has been a good deal of complaint about it in 1900. New orchards are again being planted on a large scale in Kent county and some are again planting around Middletown in New Castle county. Many believe that the yellows has run its course in Delaware, and that by careful attention in taking out trees the Peach can again be set in places where the yellows has wiped out the orchards.

6. *General Remarks.*—The geographical location of Delaware is such that no other market can approach it in nearness to the great consuming centers. It is at the gateway of the greatest cities on the continent. One night on the railroad will reach most of them, and two nights all of the desirable markets. The soils are excellent, heavy in northern Delaware, a medium loam in the central part, and a sandy loam in Sussex county. It is easily and cheaply worked, not stony, and responds kindly to treatment. Of the new lands, those recently cleared of chestnut and sassafras are preferred, but pine-land makes excellent orchards. Crimson clover, cow-peas or other cover-crops grow readily and furnish humus and nitrogen to the soil, and with the natural ease of working and cheapness of labor make it possible to bring an orchard into bearing and to maintain it at a very low cost. Late spring frosts are the most serious drawback to the business. Sometimes several crops will come through in succession, then for three or four years the crop will be killed. In the past decade there have been four crops in the state. Other drawbacks are the large orchards, making intensive culture without a large capital impossible, while still another is the tenant system of working the land, which makes it difficult



1679. Hale tree after pruning.

to introduce into general practice the most improved methods of culture.

The Peach business on the whole has been profitable to Delaware. The days, however, when fortunes were made from a single crop, when a farm was bought or a large mortgage lifted in a single season, have passed. Once those times were known in Delaware, but that was before Georgia, the Carolinas, Arkansas, the Ozark region of Missouri, Michigan, New Jersey, New York, or Connecticut had entered into the business on their present scale. Peach-growing is still attractive to planters in Delaware. More money can be made in it than in general farm crops. More attention is being given to the selection of varieties, to the care and planting of orchards, the picking and handling of the crop, and, last but not least, to the marketing of the fruit, with as many middlemen eliminated as modern business methods will allow.

Peaches Carried by Pennsylvania Railroad, Delaware Division.

Year.	Baskets.	Year.	Baskets.	Year.	Baskets.
1867	1,233,600	1879	2,598,000	1890	5
1868	13,800	1880	2,050,200	1891	3,196,717
1869	2,411,400	1881	46,800	1892	265,893
1870	1,624,200	1882	2,731,770	1893	4,208,596
1871	3,200,400	1883	1,783,447	1894	29,620
1872	2,454,000	1884	1,036,617	1895	2,100,334
1873	1,721,800	1885	1,870,496	1896	3,513,413
1874	759,000	1886	1,009,738	1807	234,876
1875	5,448,200	1887	848,347	1898	173,502
1876	1,721,200	1888	3,177,447	1899	3,157
1877	2,401,800	1889	840,577	1900	2,634,203
1878	521,400				

The figures for 1900 include the peninsula, but not two small side lines. It is estimated that 1,000,000 baskets were carried by other means and that 500,000 were used by the canneries. Probably two-thirds of the Peaches included in this estimate were grown in Delaware.

CHARLES WRIGHT.

THE PEACH IN CALIFORNIA.—There is no distinct Peach belt in California, but the Peach is grown successfully over a wide area and under varied climatic conditions. Tourists generally talk of "the California climate" as if it were one thing, but a glance at the article *California* in this work will give the reader some idea of the immense variety of climate and crop conditions.

A narrow strip along the coast is too cold for the best quality of Peaches, even where frost is unknown. A very few miles inland and up to an elevation of 2,000–3,000 ft., the Peach is at home when the grower has done his part. In a large part of the state the best results are attained only by irrigation. In some places no rain falls from the time the trees bloom until the latest fruit is gathered. There are some localities, however, where the water in the soil is close enough to the surface to give an ideal supply of moisture without irrigation. It is an odd fact that Peaches in the central part of the state ripen before those in the southern part. The time of ripening in the extreme southern part does not vary much from that of southern Ohio, while 500 miles north in the Sacramento valley they ripen two to four weeks earlier. In some of the warm foothill regions, Alexander begins to ripen the latter part of May.

All kinds of care are given orchards, as one will find in any state, but on the whole orchards probably receive much more attention in California than elsewhere in the United States. The successful orchardist has learned well the lesson that there is room at the top. The less careful have learned that there is little money in the orchard business.

In the preparation of the soil, deep plowing is all that is usually done. California soils are generally about the same all the way down, but vary much in depth. Good Peach orchard soils should be not less than 4 feet deep, and a greater depth is desirable.

The trees are usually planted 20–25 feet apart. In the southern part of the state the best practice is to grow nothing between the trees, even the first year. The tillage is thorough, deep and frequent. After February 1, tillage is given in two directions after each rain, care being taken to complete the work before the soil can bake or get hard. This double cultivation is kept up at least once a month after rains cease, which is usually in March. Thorough surface tillage is practiced after each irrigation. Tillage may be much deeper without injury in California than in most states, for the reason that there is a much warmer subsoil which permits the roots to go down deeply to reach the moisture necessary to carry them over the long periods without rain or irrigation. Orchards should be perfectly free of weeds from March 1 to the end of the growing season. Clean tillage is not sufficient. The ground must be in fine tilth from 4–6 inches deep and kept so all summer.

The low-headed tree has the preference. At planting, the nursery tree is cut back to 12–18 inches. The first six weeks after growth begins the trees are gone over at least once a week to rub off all sprouts that are not desired. Four or five are left to form the main branches; these should be as evenly distributed around the tree as possible. Also they should be as far apart in a vertical direction as possible, as two growths should not come from one place. Three or 4 feet of new growth for each branch the first year is considered fair. The first pruning occurs the following winter. About three-fourths of the season's growth is cut back and all small shoots are taken off from what is left. This facilitates even and better growth of the secondary branches that start the second year. There should be 2–3 of these branches from each primary branch, being careful to keep all others rubbed off by at least weekly visits to the tree for a month or more after growth begins. The second winter's pruning consists in cutting back one-half to three-fourths of the length of the main growths and cutting out most of the small side shoots. A few are left to bear some fruit the third year. Each fall or winter at least one-half the length of the main growths is cut back and a number of the remaining small bearing shoots are taken out. If these bearing shoots have plenty of fruit-buds near the base, it is best to cut off one-half the length of these. If they have no fruit-buds near the base (as they are not likely to have if the tree is growing very fast) they are left whole. This cutting back of the bearing shoots aids very much in the thinning of the fruit. The best practice is to cut out all shoots which fruited the previous season. They nearly all die anyway. The tree looks much better without them and is supposed to be more healthy. Nothing short of severe pruning secures the best results under ordinary circumstances.

There is no single operation of more importance than the thinning of the fruit, even after such thorough pruning as above described. There are many methods of thinning. The one that can be communicated the easiest and possibly the best (because any one can do it) is to pull off all but two Peaches from each bearing shoot. A dozen or more may be on the shoot, but they must be taken off. The usual size of such shoots is about an eighth of an inch in diameter. If they should be about ¼ inch in diameter, three or four Peaches are left. The time to thin is when the Peaches are about ⅜ inch in diameter. At this size they are likely to remain on the tree (the "May drop" being past), and if thinning is promptly done the tree's waste of strength will be small. Those who think this is severe thinning should remember that any fruit, both in bulk and weight, is eight times as large as one that has only half its diameter. The above method of pruning and thinning saves the tree from breaking down. The fruit is all marketable. The tree makes a good growth and is in fine condition for the succeeding crop. And, finally, it pays.

The varieties planted in California are largely Foster Early and Late Crawford, Muir and Salway for freestones. The Orange and Lemon Clings, for clings, are largely used by the canneries. Levi Cling is largely planted in some of the foothill regions. There are many other varieties planted in a small way. Some of the newer kinds give promise of taking a place among the regulars. A good variety of Peach for California must have large fruits and plenty of them, which will ship well and dry well. White Peaches are but little used. The canneries are paying the best prices for good yellow clings.

Three or four irrigations, about a month apart, are usually given. The furrow system is the prevalent one.

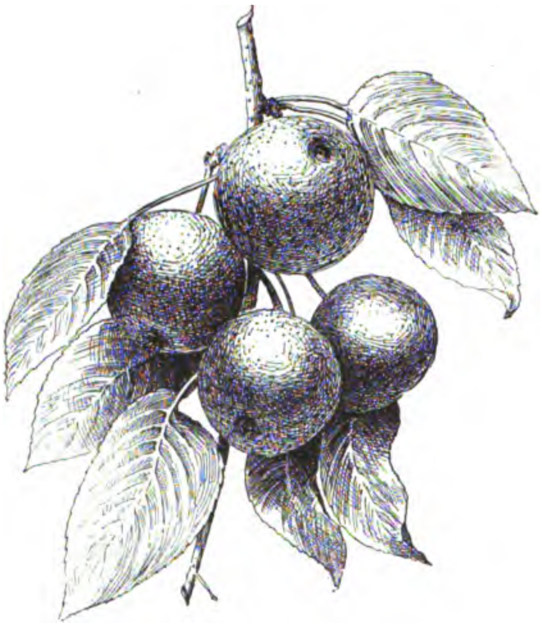
Three to six furrows are made between the rows of trees, and in these the water runs in a small stream 24–48 hours for each irrigation. The length of time depends on the soil, some soils taking in water much more freely than others. The amount applied each time should equal a rainfall of 3 or 4 inches. One irrigation after the crop is off is excellent for the succeeding crop. There are four ways of disposing of the crop—drying, shipping, local markets and canneries — though it is seldom that all of them are available in one locality. The usual net return to the grower is a little less than one cent per pound for the best fruit.

Drying is the largest opening for the disposal of the crop. The drying is all open-air sun drying, requiring 5–8 days to complete the work. The fruit is all well sulfured after cutting. The time required for exposure to the sulfur fumes is 3 or 4 hours. For best results the fruit should be just about ripe enough to eat. Drying without sulfur would make the business unprofitable as market standards now are. The sulfuring preserves the color and quality of the fruit. Ripe fruit dried without it would be black and taste burned. In cooking sulfured fruit first apply hot water for a minute or two, then pour off, cover the fruit again with water and after half an hour or more pour off again. Fruit cooked in this way may be eaten in quantity without any bad effects, and there will not be enough sulfur even to tarnish the silverware. The usual net price to the drier is 5–7 cents per pound for Peaches dried from large, well-ripened fruit and well sulfured to preserve a fine color.

H. Culbertson.

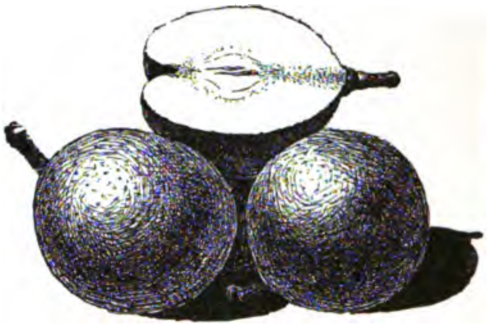
PEACOCK FLOWER. See *Poinciana regia.*

PEANUT is described under *Arachis hypogæa*, but Peanut culture is not included in this work because Peanuts are an agricultural, rather than a horticultural crop. See Farmers' Bulletin No. 25, U. S. Dept. Agric., by R. B. Handy, 24 pp., 1896.



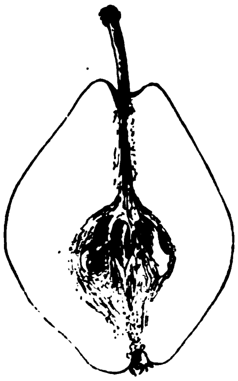
1680. The Sand Pear. Pyrus Sinensis (× ⅓).

PEAR. Plate XXVII. The cultivated Pear, as known in North America, is derived from two distinct sources, the European *Pyrus communis* and the Oriental *Pyrus Sinensis.* Pears of the European stock have been grown in North America from the earliest settlement of the country. They thrive particularly well in the New England states and New York, and west to the Great Lakes, and again on the Pacific slope. In the great interior basin, Pear culture always has been precarious, due primarily to the great liability of the trees to blight. In the southern states, the climate is too hot for the best development of the tree and the best quality of the fruit. In the north prairie states, the winter climate is so severe that the Pear tree will not grow. Some time before the middle of the century the Sand or Chinese Pear (*Pyrus Sinensis*), Fig. 1680, was introduced into the eastern states, although it attracted little attention. It soon hybridized with the common Pear, and a race of mongrel varieties was the result. Of these hybrids only two have gained great commercial prominence. These are LeConte and Kieffer. Figs. 1681–3. The LeConte was found to be well adapted to the southern states and its general introduction there after the close of the civil war was the beginning of commercial Pear culture in the south. It was first supposed to be blight-proof, but in recent years the orchards have been nearly decimated by the blight with the result that the LeConte is gradually lessening in importance and its place is being taken by the Kieffer, although the latter is by no means blight-free. The Kieffer Pear originated with Peter Kieffer, of Roxborough, Philadelphia, an Alsatian gardener, who died in 1890. He grew the Chinese Sand Pear and sold the seedlings as ornamental trees, for this species is of very distinct and handsome growth and the fruit is ornamental and fragrant. Alongside the Sand Pears were Bartletts. Amongst one of the batches of seedlings from the Sand Pear he noticed a plant with different foliage, and this he saved. Its fruit was found to be superior to the Sand Pear, and it was introduced as the Kieffer. The Kieffer Pear is now very popular in many parts of the country because of its great vigor, healthfulness, productiveness, and the keeping qualities of the fruit. In point of quality, the fruit is distinctly inferior, but it meets the demands of the market and is an excellent fruit for canning. In the cold prairie countries and other parts of the cold north, Russian Pears have gained some headway in recent years. These are merely hardy types of *Pyrus communis.* The fruit is usually of low quality, but the trees are considerably hardier than the ordinary Pear. *Pyrus Sinensis* itself bears a very hard Pear which is inedible in the raw state, but it is excellent when used as quinces are. It is fragrant and ornamental. The tree is a most vigorous and clean grower. The plant is well worth growing as an ornamental. It is used for stock for ordinary Pears, particularly in the southern states. See *Pyrus.*



1681. LeConte Pear (× ¼).

The Pear thrives on a variety of soils, but it succeeds best on those which are rather hard clay. On sandy and loamy lands it tends to be short-lived. This is due, in part, to the fact that trees grow rapidly on such lands, and are, therefore, more liable to the attacks of blight. It is now generally accepted that trees which are making a strong and soft growth are more susceptible to blight than those which grow rather slow and firm, although all trees are liable to attack. Some varieties are much more immune than others. Caution must be exercised, therefore, in the tilling of the Pear orchard. Whilst Pears profit by the best tillage, as apples and potatoes do, it is easy to carry the tilling and fertilizing so far as to produce too vigorous growth and thereby invite the blight. Therefore the most careful Pear growers use sparingly of stable manure and of nitrogenous cover-crops. They prefer to supply fertility by means of concentrated fertilizers which are not very rich in nitrogen. If, however, the trees are not making a strong and steady growth, it is as necessary to apply nitrogenous fertilizers to the Pear tree as to any other. In the interior country, Pears are likely to suffer from sun-scald, and therefore the tops are started very low, usually not more than two or three feet from the ground. Standard Pears are pruned much as apple trees are, except not so severely. Heavy pruning tends to open the top and to invite sun-scald, and it also tends to make too strong and sappy growth. After the top of the Pear tree is well formed and established, it is customary to do little pruning, only keeping the top fairly free and open. The Pear bears on spurs which continue to branch and to bear for a number of years, and in pruning it is important that these spurs be not removed unless it is desired to thin the fruit. The flowers are borne in umbel-like cymes (Fig. 1684), but in most cases only one fruit sets in a cluster. Pear trees are usually planted much closer than apple trees. The customary distance is 18–20 feet. Fig. 1686 shows an average east-American Pear orchard.

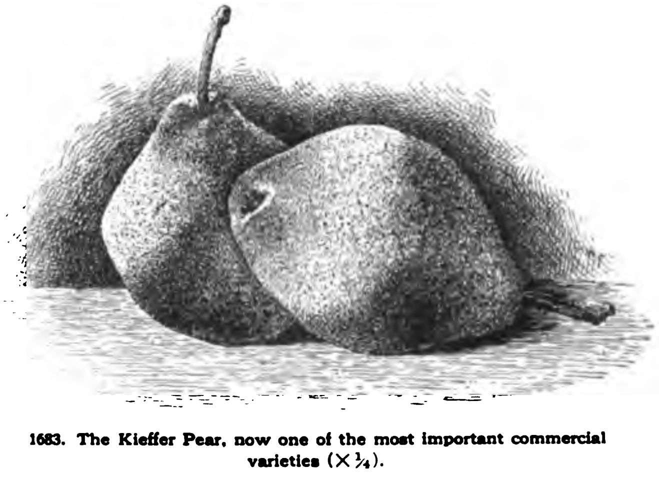


1682. Section of the Kieffer Pear, to show its ordinary form in the North.

Many of the varieties of Pears are infertile with themselves: they need the pollen of other varieties in order to cause them to set fruit freely. Probably any variety will fertilize any other variety in case the two bloom simultaneously. Such varieties as Kieffer and Bartlett are usually classed as self-sterile kinds, but the degree of sterility varies in different places and with different conditions. The safest plan in the setting of a Pear orchard is to plant not more than two rows of one variety together, and to alternate with one or two rows of another variety.

Good varieties of Pears are numerous. The one most important variety is the Bartlett (Fig. 1685), which was early introduced into the United States from Europe, where it is known as the Bonchretien. At the present time the Kieffer probably holds second place. In the eastern states, the Seckel (Fig. 1687) is a prominent variety, and is the standard of quality. Other prominent varieties are Anjou (Fig. 1688), Clairgeau, Hardy, Howell, Sheldon, and Diel. The list might be almost indefinitely extended. In the Gulf region the oriental hybrids alone are successful, and the leaders are Kieffer, LeConte, Garber, and Smith. The season of the maturity of Pears runs from midsummer, when it is introduced by Summer Doyenne and Manning Elizabeth, to late winter, when it is closed with such late winter varieties as Nelis, Josephine de Malines and others. The winter Pears are relatively little known in the eastern states. As a rule, they come into bearing late or are not very prolific; but there is no reason why they should not be better known. Winter Pears are kept as winter apples are, although somewhat greater care is necessary. They should be kept in a uniformly cool temperature. If allowed to hang too long on the tree, they become over-ripe; and then if placed in an ordinarily warm cellar, they do not keep more than one or two months. Unlike most other fruits, all Pears are greatly improved in quality if they are ripened indoors. They should be picked as soon as they have reached their full size and have begun to color, but before they have become soft, and be placed in a dry and rather cool room. If the wind is allowed to blow over them, they are likely to shrivel. If kept too warm, they ripen too quickly and soon rot. The best quality is secured when they are picked about two weeks in advance of their normal ripening.

When worked on the quince root, the Pear is easily grown as a dwarf. It then comes into bearing earlier, and, since the trees are small, the fruit can be thinned and the trees sprayed, and the fruit therefore should be of the highest quality. Dwarf Pear trees require more care than the ordinary standards, however, and they should not be planted unless the cultivator understands this fact and is willing to give the attention that they need. Although the trees are by nature dwarf, since they are worked on a smaller-growing species, they nevertheless tend to become half standard if left to themselves. Therefore they must be very severely headed-in every year. A dwarf Pear tree should never reach a greater height than twelve feet. In order to keep it down to this stature, from one-half to two-thirds of the annual growth is removed late each winter. The trees are often planted as close together as ten feet each way, but this is too close. With the ordinary broad-top pruning, which nearly all American growers give, one rod apart each way is not too great. A good dwarf Pear tree is one in which the union with the quince stock is very close to the ground. When the tree is planted, this union should be from four to six inches below the surface after the ground has settled. This deep planting prevents the breaking of the union and places the quince beyond the reach of borers. If planted deeper than this, the Pear cion may throw out roots of its own; in fact, it sometimes does this if planted only six inches deep. This rooting of the stock is no particular disadvantage, although the tree thereafter tends to grow stronger and greater pruning is necessary. An expert grower can pick out the trees which are rooted from the Pear stock by their more vigorous growth: if he desires to check this redundant growth he may cut off the Pear roots. It is the common opinion that dwarf Pear trees are short-lived. This may be true as regards the greater number of specimens which one sees about yards and on untilled areas, but a dwarf Pear orchard on good, well-drained ground, which is well-tilled and given regular pruning, will last a lifetime. There are dwarf Pear orchards in New York state which are fifty years old and are still thrifty and productive. The variety that is oftenest grown as a dwarf is the Duchess (Duchess de Angouleme). Fig. 1689. This is a large Pear of irregular shape which sells well because of its size, but it is of indifferent quality and may not be good enough for a special or personal market. Other varieties popular for dwarfs are Louise Bonne, Anjou, Clairgeau, Manning Elizabeth, and, to a less extent, Bartlett and Seckel. The Kieffer is now and then grown on dwarf stock with very good results.



1683. The Kieffer Pear, now one of the most important commercial varieties (X ¼).

The insect enemies of the Pear are numerous, but, with two or three exceptions, are not very serious. The tree is attacked by borers, although to a less extent than peaches and apples. These are kept in check by digging them out once or twice a year as on other fruit stocks. The fruit is attacked to some extent by the codlin-moth, but the arsenical sprays keep this insect in check. Of late years the psylla, attacking the growing parts, has been serious in parts of the East, although it is very irregular in its outbreaks. It can be controlled by thorough work with a spray of whale-oil soap, one pound in three to five gallons of water, beginning soon after the fruit has set, and repeating the application whenever the psyllas become numerous. In some parts of the East the fruit is attacked by the Pear midge, a minute fly whose maggots work in the very young fruit. Thorough cultivation will check this serious pest, but its complete control often involves the destruction of all the young fruit on the infested trees; in some sections the application of kainit to the soil is said to kill the insect after it leaves the fruit to undergo its transformations.

1684. Cluster of Pear flowers. (× ⅓).

The foliage and fruit of the Pear are attacked by parasitic fungi, which cause the leaves to drop and the fruit to become scabby. These diseases are readily held in check by spraying with Bordeaux mixture. Fifty years ago the White Doyenne Pear was the most popular variety for growing on the quince root, but because of the Pear scab it passed away. It was supposed that the disease was due to uncongenial climate. Since the advent of the sulfate of copper sprays, however, it has been found that the White Doyenne can be grown as well as ever. Flemish Beauty is also an example in point. Years ago it was one of the most popular standard varieties, but of late years it has been little grown because of the cracking of the fruit. It is now likely to come into vogue again for home planting. The Bordeaux mixture is a specific for the disease.

Pear blight or fire blight is the most serious disease of Pear trees. It is an American disease. It is caused by a microbe which enters through the growing points (flowers and tips of shoots) and thrives in soft or "succulent" parts. Gradually the micro-organism works down the stems, killing the tissues and causing the leaves to die. In the leaf-blight, which is a distinct disease, the leaves are more or less spotted and they fall; in the Pear blight, the leaves turn black and hang on the tree. The fire blight attacks apple trees, particularly in the Plains region. It is probably aboriginal on hawthorns and related plants. There is no perfect preventive of the disease. Some varieties seem to be relatively immune, as, for example, the Duchess. It is now generally believed that trees are more subject to the disease when they are making excessive growth; therefore it is advised that tillage and the application of stimulating manures be moderate. As soon as the disease appears, cut out the affected parts, severing them some inches below the lowest point of visible attack. Do not allow blighted branches to remain on the tree over winter. Pear blight is not equally prevalent or virulent every year.

There are no recent American books on the Pear. Two books have been written on this fruit: Thos. W. Fields' "Pear Culture," New York, 1858; P. T. Quinn's "Pear Culture for Profit," New York, 1869, New ed., 1883.

Some years ago the writer secured from the venerable T. T. Lyon, of Michigan, since deceased, an article, for publication, on the Pear. The article was not published, however, and it is reproduced below, omitting only the parts on insects and diseases. The writer is glad to place this article alongside the others in order to contrast the view-points of two generations. Mr. Lyon's article, which is most excellent and cautious and characterized by beauty of style, is of the type that we no longer see. The person who is familiar with present-day points of view will discover that it lays the emphasis on formal presentation, propagation, pruning, varieties, whereas little or no attention is given to systems of tillage, pollination, spraying, and commercial methods.

L. H. B.

THE PEAR. 1. *Its Importance.*—So far as cultivators generally are concerned, this fruit is less important than its near relative the apple, for the reason that, while the two begin to ripen at nearly the same season, there are few, if any, desirable varieties of Pears in season later than December (if we except a few austere ones, suitable only for culinary purposes), while apples are abundant for four or five months longer. Moreover, during its entire season, the Pear is supplemented by the mass of luscious, though perishable, summer and autumn fruits. The liability of very many usually excellent varieties to be rendered indifferent in quality by unfavorable seasons, neglect or unsuitable soil, is also a serious detriment to the general popularity of this fruit. The liability to the loss of the trees by blight, beyond question detracts greatly from the value of the Pear, especially for commercial purposes; while it also exerts a discouraging influence upon amateur planting. To the careful and discriminating amateur, as well as to the man of wealth, with a fondness for fruit culture, whether in person or by proxy, this fruit often assumes a prominence over any, if not all, others.

2. *Extent of Cultivation.*—Doubtless, for reasons heretofore stated, Pear trees are but sparingly planted by most persons. The fruit sent to the market comes largely from the plantations of specialists who, with soils adapted to the purpose and the necessary knowledge of varieties, have undertaken the business as a commercial enterprise. In the climates of the seaboard, and, to a considerable extent, in the region of the Great Lakes, the Pear is exceptionally successful; while away from the influence of large bodies of water, and especially in the prairie regions of the Mississippi valley, from unsuitableness of climate or soil, or both combined, the trees are liable to be either killed or seriously injured in winter, and hence are short-lived and unprofitable.

3. *Aspect.*—Perhaps in no other important particular does the climate of eastern and central North America differ more widely from that of the Pear-growing regions of Europe than in its liability to sudden and extreme variations of temperature. Owing to this climatic peculiarity, aspect becomes an important consideration in the selection of a location for a plantation of Pear trees. As a means of avoiding the full influence of exposure to the rays of the sun, during the severer paroxysms of summer heat, while the trees are in actual

1685. Bartlett Pear (× ⅓).

growth, and also to mitigate the liability to alternate freezing and thawing in winter, a northerly or northeasterly slope is to be preferred; which, however, should be so gradual as not to seriously interfere with the convenience of cultivation. As we approach the northern limit of practicable Pear culture, however, a modification of this rule of selection may be found desirable, since, with the shorter growing season, a warmer exposure may prove necessary as a means of hastening maturity.

4. *Soils.*—While the Pear tree will yield more or less satisfactory results in a variety of soils, it is found to succeed most perfectly in a strong loam, of moderate depth, overlying a porous subsoil. Soils which are liable to be wet during any considerable portion of the growing season are unfit for this purpose, unless deeply and thoroughly underdrained; while even then they are quite liable not to prove fully satisfactory. A few varieties are found to be moderately successful on sandy soils, but for general planting such soils should be avoided.

1686. Orchard of standard Pears as grown in the northeastern states.

5. *Manures.*—The liability of the Pear tree, in this climate, to the attacks of blight is thought to be increased by excessive growth. It is, therefore, desirable that the annual growth be completed and ripened at as early a date as practicable; and the more so, since the liability to blight apparently exists only while growth is in actual progress. Stable and other nitrogenous manures should, for this reason, be applied in moderate quantities, in autumn, after the liability to excite renewed growth shall be past. Potash, lime and phosphorus, which enter more or less largely into the composition of both tree and fruit, and which rarely exist in excess in the soil, may be profitably applied in either autumn or spring. Salt may also be profitably applied to the comparatively dry soils recommended for the Pear, but with care not to apply in excess. One or even two quarts may be safely applied to each tree, before the commencement of growth in the spring, if well distributed upon the surface over a space of at least 6 or 8 feet in diameter, and left to be carried gradually into the soil by dew and rain. It is believed to possess little, if any, manurial value; but to act rather as a conservator of moisture, and probably also as a repellent of insects. Coarse mulch may be placed about the trees, covering the soil as far out as the roots extend, for the purpose of keeping the earth cool, and also to check evaporation from the soil; but this should not be done as a substitute for cultivation; and the soil beneath the mulch should be kept well pulverized.

6. *Propagation.*—(*a*) By seedlings: Seeds, when to be planted for the origination of new varieties, should be selected from well-grown and fully matured fruits, of such varieties as possess in a high degree the qualities sought to be reproduced or improved, since a variety in which a characteristic is strongly developed and persistently manifested is the more likely to transmit such peculiarity to its offspring. Seeds resulting from known or artificial cross-fertilization, and therefore of known and selected parentage on both sides, offer increased probability of valuable results. Seeds intended for the origination of new varieties should be planted very thinly in strong, rich, deeply prepared soil, in a single row, and covered with not more than an inch of earth, so that the young plants shall have ample space for development.

Seeds intended for the growing of stocks for nursery purposes should be collected from varieties in which the seeds are plump and well developed, as well as from healthy, vigorous trees. American nurserymen obtain Pear seeds mostly from Europe. Seeds intended for nursery stocks are usually planted in broad, shallow drills. In our American climate the foliage and unripened wood of seedling Pears is very liable to be attacked during midsummer by leaf-blight or mildew, which prematurely arrests their growth. For this reason European stocks are generally preferred by nurserymen. This attack of mildew may often be partially or wholly avoided by planting in virgin soil remote from other cultivated grounds. Pear seedlings form a very long tap-root during their first year, with few, if any, side-roots. For this reason they are taken up preferably in autumn, and the tap-roots shortened to 6 or 8 inches, when they may be replanted in nursery rows, and earthed up, or otherwise protected from heaving, or other injury during winter; or, preferably, they may be heeled-in, in a frost-proof cellar, and planted in spring, to be budded during the ensuing summer or left to become more fully established for budding a year later.

Seedlings intended for fruiting are usually transplanted in rows, about 8 feet apart each way, with the expectation that many will be found worthless, and either removed or destroyed. Seedling Pears usually require to be fruited several years before their characteristics become fully developed. This generally recognized fact may be taken as a warning that the occasional effort to hasten the puberty of a seedling by fruiting a cion from it upon a bearing tree of different variety cannot be trusted to indicate the ultimate character of the fruit of the yet incipient variety, since it is impossible to foresee to what extent such transfer may interfere with the occult formative processes through which its ultimate qualities would have been developed.

(*b*) By budding: Seedlings of one or two years' growth, intended for standard trees, are usually planted from 6 to 10 inches apart in the nursery row; for the reason that space, as well as cultivation, must be economized to correspond with prices, although it is impossible to grow trees of good form and properly branched of the size and age demanded by most planters when thus closely planted. Trees thus closely planted should be removed, or at least thinned, after having made one year's growth from the bud; while trees intended to be grown two or more years in the nursery row, and properly branched, should be given twice or even three times the space mentioned.

The budding of Pear stocks may be done during July and August if they continue in a growing condition, but they are liable to be attacked by mildew of the foliage, for which reason they must be closely watched, and should the malady prove troublesome the budding must be done as soon as properly matured buds can be obtained. Such stocks as, for any cause, were left unbudded at budding time, together with any in which buds shall have failed, may be grafted the following spring; but this, as well as any and all grafting of the Pear, must be done very early, before the earliest movement of the sap in spring. In the spring, as soon as the swelling of the buds indicates that the germs are alive, the stocks are cut back to force them into growth. Often to insure the formation of straight, upright, symmetrical trees, careful nurserymen leave 3 or 4 inches of the stock above the insertion of the bud, to which the young shoot may be tied, if it shall fail otherwise to take an upright direction. Shoots may also be thus tied to prevent their being blown out, or otherwise injured by the wind. These stubs should be cut back to the bud when no longer needed for the purposes indicated. Such sprouts as spring from the stock in consequence of the cutting back must be removed from time to time to encourage the growth of the bud. This should be done while they are yet tender and succulent and can, therefore, be taken off without the use of a knife. This process must be repeated as they reappear, unless it is rendered unnecessary by the failure or loss of the bud. See *Graftage.*

1687. Seckel, the standard of quality (× ½).

7. *Pruning.*—Beyond that described under the head of budding, little pruning is required during the first season, except to pinch in such side shoots as threaten to rob the one intended to become the trunk of the future tree. Early in the spring of the second year, all lateral shoots must be wholly cut away, and since the Pear tends strongly to renew its growth from the terminal buds of the previous year, the shoot intended to become the trunk of the future tree must be cut down to the point at which the top is to commence, when the branches to form the head will start from the buds nearest the top. The uppermost shoot must, if needful, be confined in an upright position to constitute the continuation of the trunk.

The habits of growth of varieties differ so widely that no inflexible rule can be laid down to determine the height at which the top of a Pear tree should be commenced, unless it be that the heads of the more spreading varieties should be started higher than those of a more upright habit. The preferences of the majority of purchasers have begotten among nurserymen the practice of forming the heads of all varieties at a height of 3 or 4 feet. This height is open to the objection that, while not seriously faulty in the case of such spreading varieties as Onondaga, Osband Summer, or Flemish Beauty, it is essentially unsuited to such very upright growers as Buffum, Sterling, Clapp Favorite, and even Anjou. In this particular, as in various others, the practice of nurserymen, begotten by the preferences of the average of their customers, fails to adapt itself to the needs of the more intelligent and considerate orchardist, and to those of even smaller planters, who regard the health and productiveness of their trees as of higher importance than the possibly increased convenience of cultivation.

A proper system of primary branches, upon which to grow a permanent head, should be provided from the growth of the second season. Probably the most satisfactory provision for this purpose consists of a central shoot, with from 3 to 5 laterals diverging from the trunk at its base. A head should, in no case, be grown upon two shoots, forming a crotch, since this will be very liable to split and thus ruin the tree. A few varieties, of which Rostiezer is a notable example, have the habit of producing but few branches, and also of making successive annual growths, mainly from the terminal buds of the previous year, thus forming a too open or straggling head. Such tendency is best overcome by cutting back the branches in spring, the effect being to increase their number, though at the expense of vigor.

After the primary branches have been developed, and the growth of the third year is in progress, comparatively little pruning will be found necessary beyond the occasional cutting away of a straggling or crossing branch, although there is a class of varieties, of which Summer Doyenne and Winter Nelis are types, which, especially when growing vigorously, incline to twist and straggle so awkwardly that the branches must frequently be tied in position to insure the formation of a satisfactory head.

Prior to the third or fourth year, all pruning must necessarily have for its object the direction and encouragement of wood growth, for which purpose it is most effective when performed in late winter or early spring, while the trees are yet dormant.

The fact should not be forgotten that pruning, in proportion to its extent or severity, may be a tax upon the vigor and health of the tree, and, therefore, to be practiced as sparingly as possible. Such necessity may be to a considerable extent avoided, if the orchardist, with a well-defined ideal in mind of a tree such as he desires to produce, will, during the growing season, pass frequently through his plantation and pinch out, while yet small and succulent, all growths not needed for his purpose, at the same time "stopping" such of the reserved ones as may be too far outgrowing their fellows. With the efficient performance of this process while the framework of the top is being developed, very little pruning will remain to be done on the arrival of spring, while nearly the entire growth, which would otherwise have been pruned away in spring, will have been employed in developing the reserved branches.

While the cutting away of an occasional small branch may be done at almost any time, large branches should be removed only in case of actual necessity, and at a period early enough to permit the thorough drying and hardening of the cut surface prior to the movement of the sap in spring, as a means of preventing bleeding and consequent decay.

Summer pruning tends to check rather than encourage wood growth, and since it acts to a greater or less extent as an obstruction to the circulation, it also tends, as does the permanent bending of the branches and the hardening of the tissues, to hasten the formation of fruit-buds and the production of fruit.

The Pear may be successfully grafted upon the white thorn, the mountain ash and the apple, and such grafts have occasionally proved more or less productive for a time, but in such cases the union between stock and

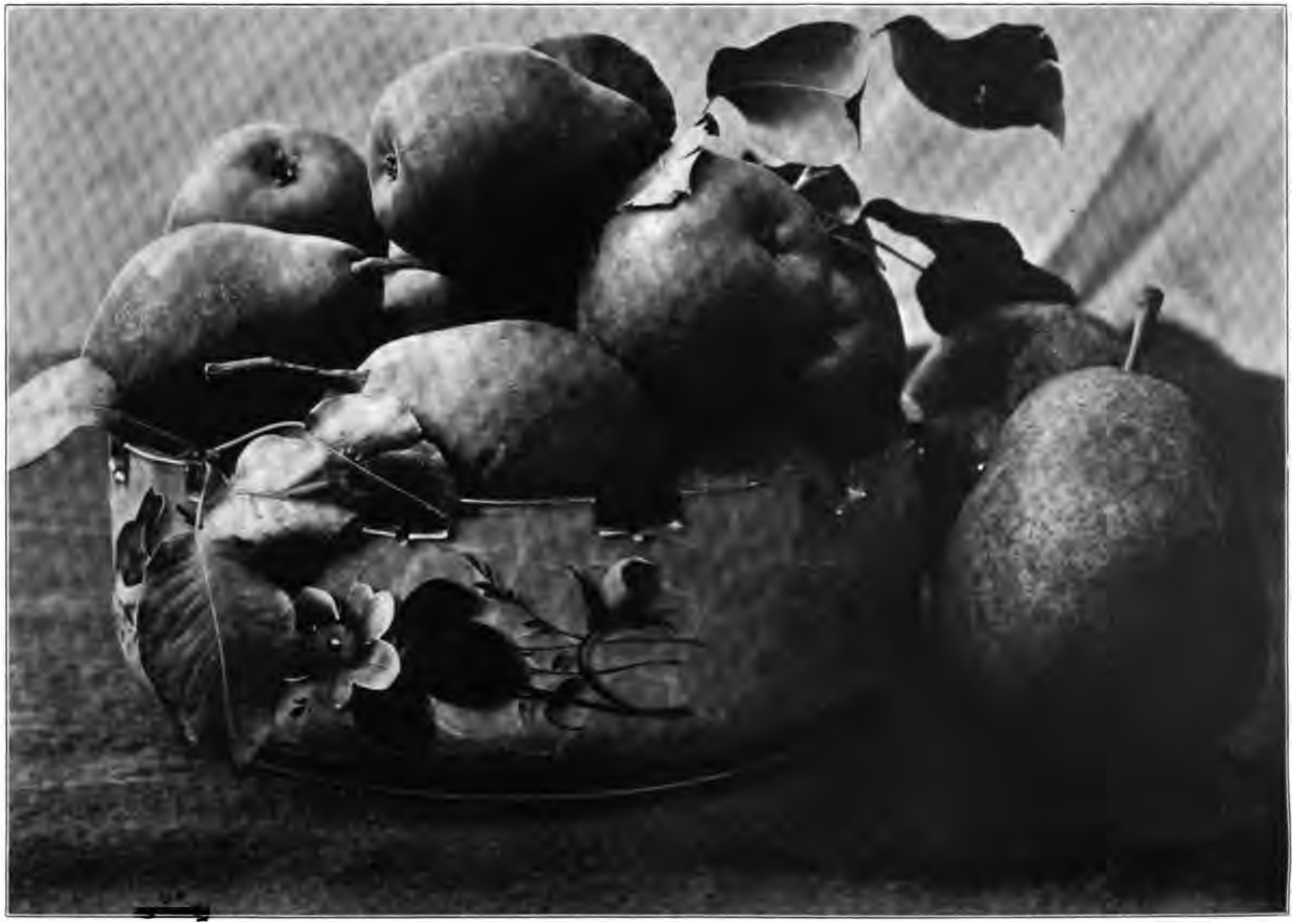


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Plate XXVII. Pears.

Louise Bonne in the dish: Angouleme (Duchess de Angouleme) on the table. One-half natural size.

cion is generally, if not always, imperfect; and such uncongenial combinations are therefore usually short-lived. The quince is the only dissimilar stock upon which the Pear is extensively grown. Quince stocks for this purpose are largely imported from France. The Angers quince is generally preferred for this purpose. These stocks are usually planted in nursery rows at the age of two years, to be budded during the following summer, in the same manner as Pear stocks. When intended for dwarf trees, nurserymen usually cut them back after one year's growth from the bud to the nearly uniform height of 18 inches, although with the more upright-growing varieties it is by many deemed preferable to branch them even 6 or 8 inches lower. Aside from the height at which they should be branched, the pruning and management should be identical with that prescribed for standards, with the important exception that when planted out for fruiting the junction between the quince and the Pear should be 3 or 4 inches below the surface to encourage the formation of roots from the Pear. Trees thus planted will commence to bear, while yet growing, solely from the quince stock, and will continue to produce fruit after rooting from the Pear, thus affording the early fruiting of the dwarf, as well as the permanency of the standard.

Not more than a specimen or two should be permitted to grow upon a dwarf the first and second years after planting. Such trees, if left to fruit freely, will almost certainly be ruined from overbearing before they are fully established. Many varieties when grown as dwarfs can never be safely allowed to mature more than a small portion of the fruit which they will naturally set.

While several varieties are found to be especially successful when grown upon the quince, most others prove only moderately so, requiring careful and expert management to insure satisfactory results. A few others, of which Bosc may be named as a prominent case, are obstinately unsuccessful upon the quince, and even when double-worked upon a dwarf of a congenial variety, their success appears to be by no means assured.

Dwarf trees trained as hereinbefore specified, are commonly known as half-standards. Other and more elaborate forms are known as pyramids, cordons, etc., descriptions of which are not deemed necessary here.

8. *Choice of Trees.*—Aside from the selection of the location for an orchard, the first important particular is the selection of the trees, leaving the choice of varieties for subsequent consideration. Trees of one year's growth from the bud are to be preferred for the following reasons: (1) Fewer roots need be injured or lost in the process of lifting and replanting, for which reason the tree may be expected the more promptly to recover from the shock of removal. (2) The single season's growth may be cut back and the top commenced to suit the preferences of the planter. (3) The top will present little or no obstacle to the force of the wind until the roots shall have gained such hold upon the soil that there will remain little liability to displacement from this cause. (4) The risk of failure from removal is greatly diminished, while the more prompt recovery and increased rate of growth of the trees in the more open orchard rows may be expected to fully compensate for one or two years more of growth in crowded nursery rows. (5) Something will also be saved in the cost of the trees and in the expense of transportation, as well as in the labor of planting.

If older or high-branched trees are not objected to, it will usually be found that they are but imperfectly branched from having been grown in crowded rows.

9. *Preparation of the Soil.*—When the late Dr. John A. Warder was asked how large the holes should be dug for planting orchard trees, he replied, "Of the full size of the orchard;" and it may also be remarked that when the ground for an orchard has been well tilled and fertilized to a depth at least equal to that at which trees are to be planted, there is no longer occasion for holes larger than shall be necessary to receive the roots in their proper position. If the subsoil be not freely pervious to water the ground must be deeply and thoroughly underdrained, and in no case should the hole in which a tree is to be planted be sunk into a subsoil so impervious as to retain water beneath or about its roots. If such retentive subsoil occurs too near the surface, and is not considered suitable to be mixed with the surface soil, it should be thoroughly disintegrated to the requisite depth by means of a subsoil plow or other equivalent device. In all nearly level, retentive soils, it will be found advantageous to "back-furrow" a land along the line of each row in the direction of the surface drainage, so that when the trees have been planted the drainage will be away from them.

10. *Laying Out, Staking and Planting.*—The most economical mode of laying out and planting an orchard, so far as space is concerned, is doubtless that commonly, but erroneously, designated as quincunx, and more correctly as hexagonal; but whether planted thus, or in rectangles, the work may be most rapidly and accurately done by planting a stake where each tree is to stand, and using what is known as a planting board, consisting of a strip of board 6 or 7 feet long, with a hole for a stake near each end, and a notch or slot intermediate and in line between them to receive the stake, and to support the tree while the earth is being carefully filled in, under, among and above its roots.

1688. Anjou, one of the popular late fall and early winter Pears (× ½). (See page 1243.)

The following are good general rules to be observed in the digging, handling, preparing and planting of trees:

1st. In digging trees aim to secure as many of the main fibrous roots as possible.

2d. Expose the roots as little as possible to the drying influence of sun and wind.

3d. Prepare the roots for planting by cutting away the bruised and broken portions.

4th. If the roots have been essentially shortened in lifting, cut away the superfluous branches and also cut back such as are to remain till a proper balance of root and top is secured.

5th. In heavy, retentive soil, plant the tree very little if any deeper than it stood in the nursery, and, in addition, raise a slight mound about the trunk to avoid the occurrence of standing water at that point.

6th. In strong but dry soil, a tree may be planted an inch or two deeper than it stood in the nursery.

7th. In light sand, with dry subsoil, a tree should be planted 3 or even 4 inches deeper than it stood in the nursery.

8th. Dig the hole in which a tree is to be planted deep enough to receive 2 or 3 inches of fine soil, before putting the tree in place, making it large enough to allow the roots to be spread out in their natural position.

9th. See that good, friable surface soil is well filled in beneath, among and over the roots.

10th. Should the soil be dry, with no immediate prospect of rain, it will be well, after nearly filling the hole with earth, to apply a pail of water, and after it shall have settled away, to fill up the hole with earth and tramp it down firmly. Staking will rarely be found necessary, except, possibly, in the case of trees old enough to have been already branched, but such stake must be watched and the tree protected against injury by rubbing against it.

1689. Duchess Pear, the most popular variety for growing on quince roots. (See page 1243.)

11. *Subsequent Cultivation.*—(*a*) Newly planted trees: Ground occupied by young trees must be kept well cultivated during the spring and early summer. If hoed crops are planted larger quantities of manure will be required, but in either case cultivation should cease as early as the beginning of August in order to hasten the ripening of the young wood. This process should be continued during at least five or six years, after which green crops may be grown and plowed under as a means, in part, of maintaining the fertility of the soil.

(*b*) Mulching: Especially during the first few years after planting, in case of hot, dry weather during the growing season, mulch may be applied to check evaporation from the soil and to keep it cool, but it should not be permitted to take the place of cultivation. The soil should be well pulverized before applying it.

(*c*) Manuring: As stated under that head (5), manures should be applied sparingly but regularly, preferably in late autumn, and should be plowed under, or otherwise mixed with the soil at that time or in the early spring, as a means of promoting early growth and the thorough ripening of the wood in advance of severe cold. Thorough maturing of the wood should also be assisted, as already said, by ceasing cultivation the early part of August.

12. *Gathering and Ripening the Fruit.*—All selected Pears, whether intended for the market or for use at home, should be carefully hand-picked.

(*a*) Gathering summer and autumn Pears: With very few exceptions all Pears acquire a higher quality if gathered before they are fully ripe. The generally accepted rule is to gather the crop when an occasionally full grown, wormy specimen is ripe, or when there is a perceptible change in the color of the maturer specimens, or when the stem parts readily from the branch if the fruit is slightly lifted.

(*b*) Ripening summer and winter Pears: When gathered the fruit should be placed in a cool room devoted to the purpose, and spread upon shelves, or in lack of a suitable room they may be placed in shallow boxes or drawers, where in due time they will acquire their full color and flavor. Since this fruit parts with moisture quite freely, it, and especially the later ripening varieties, should be protected from a drying atmosphere, particularly from drafts of air, which will cause the fruit to shrivel and become tough and leathery. It is also true of at least very many varieties that even if blown off or gathered when but two-thirds grown, the fruit if put away as already described will usually acquire a satisfactory quality. Fruits thus gathered and ripened are found to have less tendency to decay rapidly at the core.

(*c*) Gathering and ripening of winter dessert Pears: These should remain upon the tree as long as practicable without danger from frost. When gathered, they should be placed in a cool, frost-proof room, and it will be well also to wrap each separately in soft paper. Some varieties are found to ripen perfectly without further attention, but the quality of most kinds will be much improved if they are brought into a temperature of 60° or 70° a fortnight before their usual season of maturity.

(*d*) Winter cooking Pears: These should be gathered and put away in close packages in a cool, frost-proof room, in the same manner as russet apples, like which they will shrivel, and become tough and leathery, if left exposed to the air. They may remain in this condition until needed for use.

13. *Packing and Marketing.*—In America, Pears are generally packed for market directly from the tree, without awaiting the process of ripening. Barrels are largely used as packages, although this fruit is frequently put up in half-barrels and sometimes in bushel, peck and even in half-peck baskets. American growers rarely ripen their fruit before marketing it. This, if done at all, is more generally accomplished by the dealer, doubtless with decided profit, since in the larger cities fully fifty dollars have been known to be paid for a single barrel of selected fruit, and yet the same fruit ripened and offered in quantities to suit customers has been sold at two or three times the original cost. The marketing of unripened Pears is obviously unprofitable so far as the producer is concerned.

In Europe, the choicest fruits are carefully selected and house-ripened. When approaching their best condition the fruits are separately wrapped in soft paper, and are then put up in packages of perhaps one or two dozens, and sent so as to appear upon the market when in the best possible condition. Such fruits command prices quite in excess of what they would have realized had they been offered in an immature condition.

14. *Varieties.* — Since the popular and desirable varieties of Pears may be found fully described in standard pomological works, such descriptions here are not deemed necessary. Among the very numerous varieties of Pears described in such works there are doubtless many possessing high quality and other valuable characteristics, which, for some unexplained reason, have failed to attract the attention of growers.

Since varieties vary in their season of ripening with change of latitude, and often, to some extent, with change of location, even in the same latitude, the designation of such season becomes a matter of more or less difficulty. In the following lists the season given will be approximately that between the forty-second and forty-third parallels of north latitude.

(*a*) Amateur Pears: It is as true of the Pear as of most other species of fruits, that very many varieties are of small size, unattractive appearance, or of such delicate texture when ripe as to disqualify them for the market, although they may possess, in an eminent degree, the peculiar characteristics which render them desirable, and to persons of cultivated taste, indispensable for the supply of the family. Such are termed amateur Pears.

The following is a list of a few of the most popular of these, arranged approximately in the order of maturity:

Name.	*Season.**	*Remarks.*
Madeleine	m. e. July	Earliest good Pear.
Summer Doyenne	e. July	
Bloodgood	e. July. m. Aug.	
Giffard	m. Aug.	Excellent, but very perishable.
Dearborn	m. e. Aug.	
Rostiezer	m. Aug. m. Sept.	
Manning Elizabeth	e. Aug.	
Brandywine	e. Aug. b. Sept.	

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*e, early; m, middle; b, beginning.

Name.	*Season.*	*Remarks.*
Tyson	e. Aug. b. Sept.	A tardy bearer.
Stevens Genesee	b. Sept.	Rots soon at the core.
Clapp	b. m. Sept	Rots soon at the core.
Washington	m. Sept.	
Belle Lucrative	m. e. Sept.	
Bosc	e. Sept. Oct.	
White Doyenne	e. Sept. Nov.	Liable to crack badly.
Seckel	Oct.	
Sarah	Oct.	
Anjou	Oct. Nov.	
Gray Doyenne	m. Oct. Nov.	
Reeder	Nov.	
Emile d'Heyst	Nov. Dec.	
Mount Vernon	Nov. Dec.	
Dana Hovey	Nov. Jan.	
Langelier	Nov. Feb.	
Prince St. Germain	Nov. March.	
Lawrence	Dec.	
Winter Nelis	Dec. Jan.	
Easter	Jan. March	Succeeds best at the South.

(*b*) Culinary Pears: Very few dessert Pears are found to be satisfactory for culinary uses, since they too generally lose at least a portion of their flavor and aroma in the process of cooking. There are, however, several varieties of high, austere character which prove adapted to this purpose, among which are the following:

Name.	*Season.*	*Remarks.*
Vicar	Nov. Jan.	Occasionally good enough for dessert.
Black Worcester	Nov. Feb.	
Catillac	Nov. March.	
Pound	Dec. Feb.	

(*c*) Market Pears: The markets demand varieties of attractive appearance, of at least medium size and of fine texture. To the grower, productiveness and vigor of tree are also of primary importance. If possessing the foregoing characteristics, a variety may prove at least temporarily popular, even though of comparatively low quality. The following varieties, some of which may also be found in the amateur list, are all more or less popular as market fruits:

Name.	*Season.*	*Remarks.*
Tyson	e. Aug. b. Sept.	Excellent, but a tardy bearer.
Sterling	e. Aug, m. Sept.	Productive, and exceedingly beautiful.
Clapp	b. m. Sept	Rots soon at the core.
Bartlett	b. e. Sept	Leading market Pear.
Souvenir du Congress	b. e. Sept	Sometimes very large.
Buffum	m. Sept	Variable in quality.
Howell	m. Sept. Oct.	
Flemish Beauty	m. e. Sept	Rots soon at the core.
Bosc	e. Sept. Oct.	Excellent for all purposes.
Boussock	e. Sept. Oct.	
Louise Bonne	e. Sept. Oct.	Grown only as a dwarf.
Onondaga	e. Sept. Nov.	
Superfin	Oct.	
Sheldon	Oct.	Is russeted and dull in color.
Rutter	Oct. Nov.	
Anjou	Oct. Nov.	
Kieffer	Oct. Nov	Not valuable north of 43°.
Le Conte	Oct. Nov.	Succeeds best at the extreme south.
Angouleme	Oct. Nov.	Grown only on quince stocks.
Diel	Oct. Dec.	
Clairgeau	Oct. Jan.	
Columbia	Nov. Jan.	
McLaughlin	Nov. Jan.	
Lawrence	Dec.	
Josephine of Malines	Jan. Feb.	

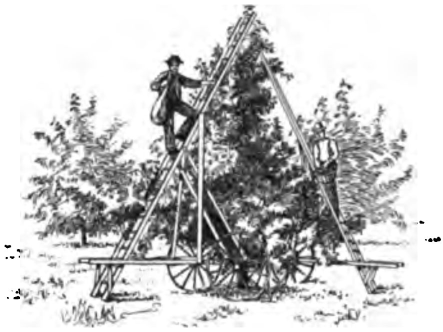
15. *Relative Desirableness of Dwarfs.*—There are a few varieties, among which Louise Bonne and Angouleme may be especially mentioned, which on free (Pear) stocks are either tardy bearers or require to be fruited several years before developing their ultimate qualities, but which succeed unusually well upon the quince, developing at once upon that stock their ultimate qualities. These, especially the Angouleme, are valued as market varieties when grown as dwarfs.

Angouleme, and perhaps some other varieties as dwarfs, occasionally bloom so profusely as apparently to prove unable to develop the fruit, which in consequence proves abortive. The natural and obvious remedy in such case is disbudding, or its equivalent, cutting-back the fruit-bearing shoots before growth is commenced.

The fact that very many varieties are not permanently successful when grown upon the quince is doubtless partially, if not in many cases even wholly, due to their increased tendency to early and excessive productiveness when grown upon that stock, which, owing to the very common unwillingness of the grower to remove the excess of fruit, is allowed to consume the material needed for wood growth, and thus to occasion exhaustion before the tree has gained a thorough hold upon the soil.

If, with any variety capable of forming a satisfactory union with the quince, and with the tree planted in the manner heretofore described, the entire crop of bloom or incipient fruit of the first one, two or even three years (dependent upon the vigor of the tree) were removed, and if subsequent crops were carefully and thoroughly thinned, it is at least highly probable that permanent health and longevity would prove nearly or quite as general with dwarfs as with standards, thus permitting the more extensive growth of the Pear in greater variety in small or amateur plantations and in limited grounds than is practicable with the use of standards.

T. T. Lyon.



1690. Ladders used in New Jersey for picking Pears. (See p. 1250.)

Pears on the Northern Plains.—The culture of Pears in the middle west follows the general lines of Pear growing in the Atlantic States, but there are some radical points of difference. The difficulties of Pear growing in the upper Mississippi Valley are many and grievous. Above the fortieth parallel and west of the Great Lakes, nearly all efforts have been failures. The best successes have been on high, rather steep ridges and bluffs near watercourses, with light colored clay soils and northerly exposures. Pear trees are not planted to the bottom or to the top, but in belts midway around the slopes. Plums may be used lower down and cherries above.

The ground should be already set in clover or blue grass. Small circles are spaded out for the trees. These are cultivated with the hoe and widened with the growth of the tree. Small trees branched very low are best. The trees may be cut back the second year to within a few inches of the ground. Only a very moderate annual growth is desirable.

Use no manure until the tree has borne several crops of fruit, and then only with extreme care. Rich, black soils, plenty of manure and clean culture are deadly to Pear trees in this region.

The critical period is that of the first fruit crop. The deadly enemy is blight, which is sure to appear then. The successful Pear grower must not neglect his orchard a single day during the season of blight, but watch for the enemy and cut out and burn every blighted twig as soon as seen. Sultry, damp weather in June is most critical.

Such varieties as Warner, Longworth, Vermont Beauty, Koonce, Kieffer, etc., are said to succeed further north and resist blight better than any others. Under slightly more favorable conditions, Clairgeau, Howell, Seckel, Tyson, Washington, Flemish Beauty, etc., may be used.

The hardiest and blight-resistant varieties may be grown and when in bearing a branch or two grafted with a more delicate sort with success.

C. L. Watrous.

The Pear in California.—Visitors at the old California missions during the early part of the century noted the presence of seedling Pear trees in the mission gardens. Many of these trees survived the neglect which came upon the mission properties after the secularization, and were in thrifty growth and bearing at the time of the American occupation. The first Pears sold in San Francisco and in the mines in 1849–50 were gathered from old mission trees, and some of these old trees grafted over, gave the first California product of the popular European and American varieties of half a century ago. From this beginning the growth of Pears increased until the commercial product of 1899 included the following: 1684 carloads sent overland to eastern and foreign markets (about the same as for the five years preceding); 5,760,000 lbs. dried Pears shipped to the same destination (a million pounds less than the preceding year); 483,384 cases of canned Bartletts and 24,772 cases of other Pears canned, which was 140,000 cases more than the preceding year. There are about one and one-half million Pear trees in California orchards.

It is a most interesting fact that a single variety furnishes a very great part, perhaps even as much as four-fifths, of the Pear products of the state, and that is the Bartlett. Whatever it may lack in high quality is more than compensated for by its commercial serviceability. It is handsome and of good size, endures long carriage, cans well and dries well, and is of sufficiently good quality to please consumers: in fact the California grown Bartlett is said to be better than the same variety grown in the Atlantic states and in the west of Europe. This is not, however, the chief reason why the Bartlett so largely preponderates in California. The ruling condition is found in the fact that owing to the marked differences in localities not widely distant and yet differing in elevation, in exposure to coast influences and away from them, and other local causes, the Bartlett has a very long ripening season, and valley, coast and mountain Bartletts follow each other through nearly three months and thus make succession of different varieties during this period unnecessary. There is, however, at present a greater disposition than hitherto to extend the season by growing other varieties, but they are selected for resemblance to the Bartlett type. Clapp Favorite is sold as an "Early Bartlett," and a Winter Bartlett, an Oregon seedling, is now being planted to carry the same style of a Pear as late as possible. Still some progress is being made in extending the California list of popular Pears and some of local and of distant origin will probably achieve prominence, especially in the shipments to distant markets.

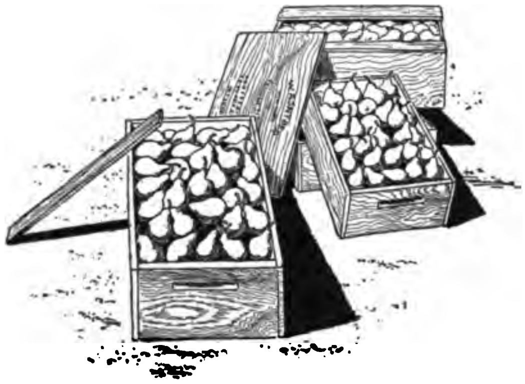
1691. Dwarf Pear trees 45 years old, in the Yeomans orchard.

California Pears are grown on Pear-seedling roots—very little recourse being had to rooted cuttings or to dwarfing stocks. A dwarf Pear tree is almost a curiosity. The heavier loams and even clays are sometimes planted with Pear trees, not because they are best for Pears but because other fruits do worse than they. To fully plant the area intended for fruit, Pears will go on the intrusions of heavy or too moist soils, while the freer soil will be given to other fruits. Still the chief product of Pears is from the best loams California affords, and the profits from the tree warrant the use of such land. Pear trees are regularly pruned to a low vase form, but seldom opened in the center, the interior being used for bearing wood, and foliage enough retained to partially shade the fruit. The fruit is thinned to favor size and to relieve the tree from overbearing. Irrigation is employed in some parts of the state. The varieties chiefly grown are the following: Bartlett, Anjou, Clairgeau, Clapp, Comice, Dana Hovey, Easter, Hardy, P. Barry (a California seedling), Seckel, and Winter Nelis.

E. J. Wickson.

The Kieffer Pear was grown from seed of the Chinese Sand Pear, probably crossed with the Bartlett, by Peter Kieffer, a horticulturist, who lived near Philadelphia. He first exhibited the fruit at the Centennial Exhibition, in 1876, in that city. See p. 1242. The planting of orchards of this valuable Pear began soon after this time and has continued ever since, more largely in the past 2 or 3 years than ever before. The Kieffer being wonderfully productive, the planting having gone on apace, and none of the earlier planted orchards having ceased to exist, the question may properly arise, with the great probable increase in the production of the fruit, What of the markets?

We in the East have been shipping Kieffer Pears by car-loads, sometimes packed in barrels, at other times loose or in bulk to be packed at destination, to cities in the middle West, but those cities in the future will be largely supplied with fruit grown near by. This Pear has grown in favor with consumers, to an extent fully equal to the increased production. It was observed in the Philadelphia and New York retail markets and fruit stands that during the months of October and November, in 1898 and 1899, there were very few Pears offered, except the Kieffer. It is excellent for canning and preserving, and it is fortunate that such is the case, so that a large part of future crops may be used in this manner. The Kieffer will flourish on almost any ordinary farm land, but sandy loam is preferred with gravel or clay subsoil, and prefer planting, what would generally be considered close, 150 to 200 trees per acre, leaving a driveway of 22 to 24 feet every 3 or 5 rows, on which to cart the fruit from the orchard. By close planting the trees protect each other from the winds to a great extent. Two-year trees are best for planting; let them head low, 2 or 3 feet, cut back at planting and annually for several years one-half of preceding year's growth, and keep top thinned so it will not be too dense. In this way one will have a sturdy tree that will carry two or more barrels of fruit in such shape that the orchard can be cultivated until the Pears are of marketable size. In the season of 1899 a yield of over 16,000 barrels of Kieffers was had from 80 acres of land, and now, on August 30, 1900, there is a prospect of a similar yield. An 8-foot Clark cutaway, drawn by 4 mules, is still running in the orchard. In our first orchard planting of the Kieffer we were not advised of the importance of pollination, and planted large blocks without mixing in other sorts; the results were very little fruit, except on trees near to or adjoining orchards of other varieties; there Kieffer trees produced uniformly good crops. It was a heavy loss to have an orchard in this shape for several years; the remedy seemed to be, and was, to top-graft some of the Kieffer, and also to replant to other sorts blossoming at the same time. A mixture of not less than one-tenth of Le Conte or Garber answered the purpose. One to 3 per cent of the orchard trees die annually from a sort of body blight; the spaces are reset with other trees, which bear fruit in a few years. In picking the fruit we use ladders hung on wheels (old carriage wheels), which are readily handled and safe. Ladders 12 to 24 or even 30 feet can be used, but with one of 18 feet, properly hung, a man can pick Pears from the top limbs 20 feet high and the ladder need not touch the tree. Fig. 1690. The orchard can be gone over quickly and the high Pears picked first, these being most likely to be blown off and to be bruised in falling. We use, in handling our fruit from the orchard, baskets holding ⅝ bushel, and cart into packing house on low wagons, the platform of which is made of 2-inch hemlock plank 18 feet long and hung as low as will permit a 2-foot front wheel to turn under; being low it is very convenient to load from the ground. A man can readily load 70 to 80 baskets without getting on the wagon, and the packing house floor is about the same height as the low wagon for convenience of unloading and reloading on other wagons for carting to markets. JOHN S. COLLINS.



1692. Packing Pears for export.

DWARF PEARS.—Dwarf Pear trees are produced by budding the Pear-wood upon the French quince. The point of union should be so low that, when the young trees are transplanted into the orchard, this point will be 3 or 4 inches below the surface of the ground. The quince, being naturally of a slower growth than the Pear, will, by the moisture of the ground and its protection from the drying effects of the atmosphere, be kept more nearly equal to the size of the Pear. As the tree becomes older the Pear will throw out Pear roots at the union, which will give increased vigor and strength to the tree in its years of maturity when producing heavy crops of fruit.

The soil best adapted to dwarf Pears is a rich loam, with a subsoil which requires thorough underdraining—a tile drain within 5 feet of every tree in the orchard would be thorough draining. The soil should be good strong corn or potato ground, and kept in such condition of fertility from year to year, for which purpose good, well composted, barnyard manure has no equal, but may be supplemented by other fertilizers—as ground bone and potash. Small crops, as beans and potatoes, may be grown between the trees the first few years after planting, but never should they be allowed in the least to interfere with thorough tillage, or to rob the trees of proper and desirable nourishment. The growth of the tree is of far greater value than any farm crops which can be grown between the trees. The soil should be thoroughly cultivated at least every 10 to 15 days during the growing season till about August 15 to September 1. It should cease in time that the wood may fully ripen. Suitable cultivation can hardly be given with any crop on the ground, except, possibly, when sufficient space is left without a crop next to the trees.

The trees should be planted in rows 15 feet each way, or in rows 20 feet apart each way with one tree in the center of each square. As the trees become older the entire ground should be given up to frequent cultivation, and under no conditions should a dwarf Pear orchard be seeded to grass, unless to clover for the purpose of plowing it under for fertilization.

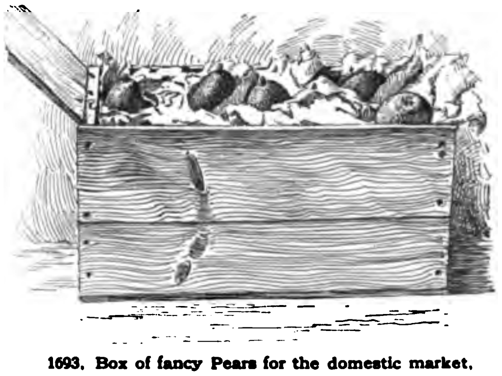
Dwarf Pears require thorough annual pruning, which may be done at any convenient time after the falling of the foliage and before the buds become in the least swollen in the spring; but where the cold is severe it is better not to prune till about the first to middle of March. This pruning should begin with the first year, and be continued annually during the life of the tree, cutting back all of the new growth to within 4 to 8 buds, and thinning out all surplus branches which will not be wanted for limbs to the tree, so that at maturity the tree shall be open-headed, with opportunity for plenty of air and sunshine all through the tree, without which superior quality of fruit cannot be grown. The lower limbs should be within 20 to 24 inches of the ground. Trees when 20 to 50 years old should not be more than 12 to 14 feet high, and the diameter of the branches about 12 to 16 feet. See Fig. 1691. It is a very erroneous impression that a dwarf Pear orchard under proper conditions is short lived. There are in the United States orchards in vigorous condition, and now producing annual crops, that are from thirty to fifty years old.

Some of the advantages of dwarf over standard Pears are: more trees can be planted to the acre, they commence bearing much younger, the fruit is not so liable to be blown off by early winds before maturity, it is much more quickly and easily gathered than from high trees, the fruit is larger and of better quality than that on standards. All varieties do not succeed equally well as dwarfs, because they do not all form an equally perfect union with the quince. Duchess is the leading and most profitable variety now grown as dwarf, although many others succeed well. L. T. YEOMANS.

PEARS FOR EXPORT.—Pears have not been grown for the export trade to any large extent, but there is no good reason for it. As France supplies the English market with the finest Pears that are grown, the American shipper needs to study the varieties, season, and extent of the French supplies to avoid a difficult competition which has to be met in seasons of full production. When the Pear crop has been light on the continent, as often occurs, we have successfully exported the Louise Bonne, Anjou, Bosc, and Winter Nelis. Later varieties, as the Easter and Josephine de Malines, with their very fine quality, would meet with ready sale in foreign markets.

As size and quality are important factors with English buyers, Pears for export should be grown upon dwarf trees, that close pruning may be done, the fruit judiciously thinned, and the much higher culture given that the dwarf tree requires.

The fruit should be gathered when it has reached its most perfect development, but not allowed to come to its full maturity, or approximate ripening. This is the right condition of fruit when it is to be shipped without refrigeration. With refrigeration, a little fuller maturity may be allowed. Each specimen should be wrapped in paper. A layer of excelsior should be placed on the bottom of the box, which is marked to be opened; over this place a sheet of paper. Pack the Pears in single layers, covering each with paper and excelsior until the box is filled, nailing cover securely under considerable pressure. Boxes should hold 36 large Pears, and 60 of medium size. Fig. 1692. This is a refinement of even the best packing for the common domestic trade. Fig. 1693. The risk in exporting is in the lack of proper facilities on steamers that are not fitted with refrigeration. The fruit often becomes overheated and decays



1693. Box of fancy Pears for the domestic market, each Pear wrapped in paper.

in passage. Another cause for loss is rough handling. In unloading, the boxes are slid on planks, and if they are not removed promptly at the bottom of the gangway, one box strikes heavily against the side of another, bruises the fruit and its sale is injured. The best efforts and work of an entire season may be sacrificed at this point. When the fruit arrives, and opens in perfect condition, the prices received are usually 40 per cent greater than those of the home market. The best results are obtained when the Pears are packed and shipped direct from the orchard.

With fruit of superior quality, better steamer facilities, and more careful handling, a large quantity of American Pears can be exported, for foreign markets are steadily demanding and receiving increased supplies.

George T. Powell.

PEAR. **Alligator P.**, *Persea gratissima.* **Avocado P.**, *Persea gratissima.* **Balsam P.**, *Momordica Charantia.* **Garlic P.**, *Cratæva gynandra.* **Prickly P.**, *Opuntia.*

PEARL BUSH, *Exochorda grandiflora.* **Pearl Fruit**, *Margyricarpus setosus.* **Pearl Weed** or **Pearl Wort**, *Sagina.*

PEAT is a kind of soil formed by the partial decay of plants in the swamps of the temperate zone. It is a standard potting material in greenhouse work for certain classes of plants, as ferns, orchids, heaths, rhododendrons and other ericaceous plants, woody plants from Australia and the Cape of Good Hope, and many other choice and difficult subjects. American gardeners complain that they are handicapped in growing such plants because American Peat is poorer than European, the lack of fiber being chiefly deplored.

The Peat bogs of England are often 5 or 6 feet deep, and some of the Irish ones are said to be as deep as 40 feet. They have been forming ever since the glacial period, but are now on the decline, owing largely to natural causes. Peat bogs represent the decay of many kinds of aquatic and marsh plants, but chiefly sphagnum (which see). This moss grows upward and decays below. Near the top the Peat is brown, fibrous, light and porous: lower down it tends to be black, heavy, dense and without indication of its vegetable origin. The ash varies from 1 or 2 per cent in newly formed Peat to 10, 20, or even 30 per cent in the older Peat. Peat is commonly used for fuel by the Irish peasantry, but almost never in America. In greenhouse work Peat is valued more for its porous, moisture-holding properties than for its plant-food. If dried, it may be used as an absorbent for liquid manure, "not so much for its inherent value," says Roberts (in his "Fertility of the Land"), "as for conserving the nitrogen in the manure, and for improving the condition of the stables."

The transformation of Peat bogs into arable land is rarely a pressing problem in America. It is usually too costly for a new country. The notion, however, is very common that Peat lands are extraordinarily rich in plant-food. Nevertheless, according to Roberts, swamp muck and Peat are not richer in plant-food than the good soils, with the exception of the nitrogen in the Peat, which, without doubt, is far less available than it is in good soils. (American Peat contains about .67 per cent nitrogen, .21 per cent phosphoric acid, and .13 per cent potash.) Peat lands differ from good, arable soil in being cold, sour, and too wet. To reclaim them one must drain off the superfluous water and apply lime freely to destroy the harmful organic acids. Sometimes sand or clay may be added to improve the texture. Tillage opens the soil to air, warms it, makes it uncongenial for nitrites, and congenial for nitrates. It takes time to reclaim Peat lands. Thoroughly decayed Peat is muck.

W. M.

Peat is chiefly composed of vegetable matter in what might be termed a state of suspended or partial decay. The soil which covers the greater portion of the earth's surface has been made by the disintegration of rocks and stones, through the agency of frost, water, and the atmosphere, and is composed mostly of sand and clay, these differing in proportions according to locality. Such soils are spoken of as inorganic soils, since they contain but a small percentage of organic or vegetable matter. Peat, on the other hand, is spoken of as an organic soil, since it is composed largely of vegetable matter, often as much as 97 per cent. It is formed either in the presence of water or peculiar climatic conditions. That which has been formed under the influence of water is found in swamps or the places from which water cannot pass away readily. Aquatic plants and mosses flourish, and at the end of the growing season they die down; vegetation is renewed the following season, and so on until the layers of decaying vegetation rise above the surface of the water, when ferns and plants of a more ligneous character generally establish themselves and give firmness to the surface.

That which is dominated by climatic conditions, as on the silicious sands of some parts of England, and on the heathy sands in the north of Germany, is composed principally of the roots of heaths, mosses, and other cryptogams which grew among the heaths. It forms a stratum of what might be spoken of as a very fibrous and elastic turf, usually not more than 3 or 4 inches in thickness. This Peat is not often found in this country; at least the writer presumes not, as he has not seen it offered in commercial catalogues which offer orchid supplies, though they offer fern-root, bog Peat, and occasionally, "imported Peat for orchids." The fiber is very fine and uniform, and is the ideal material for orchids, anthuriums and other tropical subjects with roots of a more or less aërial character, as it may be broken into small nodules of fiber which do not decay readily with the abundance of water and humid conditions that such plants must have at certain seasons. From its porous nature, the surplus water not only passes off readily, but there is also free entrance of air, which is as essential as water for the supply of oxygen to the roots; and by the admission of air, the material is kept in good physical condition. For these reasons, also, it is the ideal material in which to grow ericas, epacris, and other genera of the family Ericaceæ, though owing to the hot summers of this country these last-named plants cannot be grown to the perfection which they attain in England. Peat which is found in swamps is abundant in this country. It differs from the European product in not having the necessary fiber. Though not of much use for orchids, anthuriums, etc., it is useful in potting ferns, and in preparing beds for planting rhododendrons, kalmias, and other larger-growing plants of the Ericaceæ. It is also useful in mixing soils for vases which have to stand in exposed positions outdoors during the summer, since it is more retentive of moisture than ordinary soil. As a substitute for the European Peat in orchid culture, etc., American gardeners use kalmia-root and fern-root, especially the latter, which may generally be found in quantity upon the surface of the Peat which has risen above the water. When choice can be had the roots of the more slender-growing ferns are preferable to the larger and stronger-growing species, since the roots are correspondingly finer.

Edward J. Canning.

PEA-TREE. *Caragana;* also *Sesbanea.*

PECAN (*Hicòria Pecán*, Britt. *Càrya olivæfòrmis*, Nutt.). Of the 10 or more species of hickory, the Pecan is the most important from the horticultural standpoint. Possessing, as it does, the desirable qualities of rapid growth, reasonable precocity and productiveness, and producing a nut with thin shell, good cracking quality, full kernel and delicate flavor, it may well rank first among our native nuts in value and cultural importance. Its probable cultural value has long been recognized, but only within the last twenty-five or thirty years has there been systematic planting of the trees in orchard form with a view to deriving profit from the sale of the crops of nuts. By far the larger part of the commercial product of Pecans is still obtained from the wild trees of Texas, Louisiana and Mississippi.

The species is indigenous on lowlands and river bottoms throughout most of the valley of the Mississippi and its larger tributaries. It is found as far north as Davenport, Iowa, in the main valley, Covington, Ky., in that of the Ohio, and Terre Haute, Ind., in that of the

Wabash. It is also abundant througnout eastern and central Texas, extending southward into Mexico, but nowhere reaching the immediate coast of the Gulf. The area of natural distribution, therefore, covers considerable portions of Ohio, Indiana, Illinois, Iowa, Missouri, Kansas, Oklahoma, Indian Territory, Arkansas, Kentucky, Tennessee, Alabama, Mississippi, Louisiana and Texas. Commercial plantations of considerable size have been made in most of these states, and outside of this area in North and South Carolina, Georgia, Florida, New Mexico, California and Oregon. Small experimental plantings have been made in most of the middle and northern states. The cultural era of the Pecan may, therefore, be considered as now fairly entered upon.

Under favorable conditions of soil within its natural range, the tree attains majestic, dome-like proportions, reaching a trunk diameter of 4 to 6 ft., with a height of 100 to 175 ft. and a spread of top of 60 to 70 ft. Some of the largest trees recorded are found in Illinois and Indiana in the valley of the Wabash river, near the northern limit of its natural distribution. This tendency to attain great size under favorable conditions gives rise to puzzling questions regarding the proper distance for planting in orchard form to insure the health, vigor and productiveness of the trees as they approach maturity. It has also given rise to much speculation as to the possibility of dwarfing the tree by propagating upon other species and thus, by reducing the size of top and trunk, to render the tree more tractable and if possible increase its proportional productiveness. Little careful and systematic work has been done on this line, however, most of the planted orchards still consisting of seedling trees.

Commercial Importance of the Pecan.—The importance of the Pecan as an article of commerce seems not to have been generally recognized until after the civil war. As in the case of the Florida orange, the favor which it met with from the soldiers of the Union army doubtless did much to spread its reputation in northern cities, and to pave the way for a favorable reception when first shipped in large quantities, during the period of 1870 to 1880. Since then the increase in demand has been rapid and steady, and for many years the large, thin-shelled varieties have retailed at higher prices than are obtained for any other American-grown nut. Choice Pecans of large size rarely retail in northern cities at less than 40 cents per pound and frequently rise to 75 cents for a fancy article.

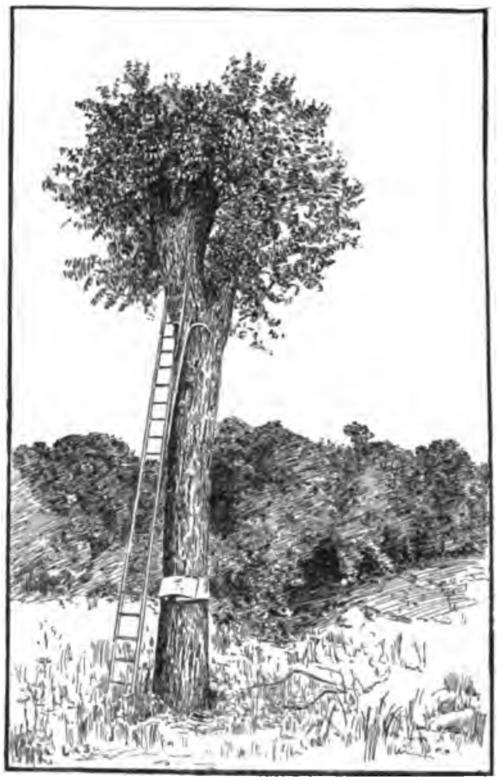
Accurate statistical data on the total yield and value of the crop are lacking, but the yield often runs into the millions of pounds per annum, single firms in Texas having handled upwards of 500,000 lbs. in a season. A large and growing demand for Pecan meats has developed among confectioners, one New York dealer having prepared and marketed 100,000 lbs. of these in a year.

From the favor with which exhibits of this nut in the American section at the Paris Exposition of 1900 were received, it seems probable that a considerable export trade can be developed whenever the supply of choice nuts exceeds the demand for domestic consumption.

Climatic and Soil Requirements. — From its wide area of natural distribution, covering, as it does, more than fifteen degrees of latitude, the species may be expected to thrive in most of the regions adapted to the culture of the common tree fruits of the north temperate zone. Trees from different latitudes are found to vary greatly in hardiness, as would be expected. Seedlings from the lower Mississippi valley succumb to the winters of Massachusetts and Michigan, when trees grown from Indiana, Illinois and Iowa seed survive uninjured. On account of lack of productiveness and the small size of nuts in the North, the area of probable profitable planting east of the Rocky mountains is not likely to extend north of the Potomac and Ohio rivers. In portions of California and Oregon the trees are reported to make a strong and thrifty growth, but there is general complaint there of lack of productiveness. Within the area in which the species succeeds, most of the profitable trees at this time are on moist and relatively fertile soil.

The moist, clayey and sandy loams of river bottoms subject to occasional overflow, are peculiarly adapted to this tree. It thrives on fertile uplands that are sufficiently moist and rich, and even on light, sandy soils when well fertilized, but the cost of the fertilizing necessary on light soils is probably too great to leave a possible profit in the culture of the Pecan. In Texas, certain soils underlaid with hard-pan are reported to have been fitted for planting by exploding a charge of dynamite in the hole where the tree is to be planted, thus loosening the soil, affording drainage and preparing it for easy penetration by the roots.

Propagating.—During the earlier years of Pecan orcharding none but seedling trees were planted. Many of the planters believed (as some still contend) that the seedlings would come true to type and that efforts to perpetuate valuable varieties by budding or grafting were unnecessary. As larger numbers of trees of known parentage have come into bearing it has become evident that the variation among seedlings of this species is very great and that a large proportion of the seedlings of choice varieties fail to equal the parent in vigor and productiveness of tree or size and quality of fruit. Fig. 1695 shows an instance of such variation, the thirteen forms illustrated having been produced by thirteen different seedling trees grown from one crop of nuts from a single isolated tree, by B. M. Young, Morgan City, La. Mr. Young states further that other seedlings from the same tree showed even greater variation, and that with few exceptions the nuts of the seedlings were smaller than those of the parent tree. These seedlings show little variation in vigor of growth, but vary as greatly in productiveness as in size of nut, the largest crop yet borne by the least productive consisting of less than five pounds of nuts, while the most productive has for two years borne upwards of one hundred and fifty pounds of nuts.

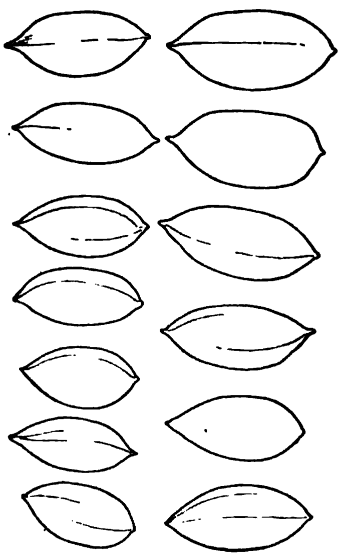


1694. Top-grafted Pecan.
Four years after the operation. (Page 1254.)

The early attempts to propagate the Pecan by the methods of budding and grafting practiced on the more common orchard trees were rarely successful, and the opinion became prevalent that this species could not be budded or grafted. Various devices for propagating by layers, by upturned roots and root-cuttings were suggested and tested at different times, but none of these proved of permanent value.

The first really successful work in graft-propagation seems to have been by crown-grafting on Pecan stocks. This is most commonly practiced in early spring on stocks in place, having a crown diameter of from 1 inch to 2 or 3 inches. The stock should be cut off smoothly at the crown and grafted either by splice, or side-cleft graft, according to size of stock. Cions with terminal buds are preferable, and they should in all cases be so cut that but one scarf exposes the pith. In this method no wax is used, but the grafted stump is carefully mounded up with moist earth to the top bud of the cion, to prevent drying out. In the humid and mild climate of the Gulf states, this is probably the most promising method for the inexperienced amateur. Bench-splice root-grafting on 6-inch top sections of one-year-old seedlings has been fairly successful in some cases, but grafts set on lower sections of root are not considered worthy of planting out. Annular budding on the new wood of second-year seedlings yields a considerable proportion of success when favorable climatic conditions prevail, but in unfavorable seasons, as of extreme drought or heavy rainfall, it results in almost total failure even with expert operators.

Top-working of the Pecan is generally difficult, only a small percentage of success usually being obtained with any method. On young trees of Pecan, Water Hickory (*H. aquatica*) or Mocker nut (*H. alba*), not exceeding one inch in diameter, occasional success by splice-grafting is obtained in Florida. Diagonal side-grafting on various hickory stocks is also occasionally successful in Florida, but no orchards of commercial importance have as yet resulted from any of these methods of propagation.



1695. Outlines, showing variation in the Pecan (× ½). All grown from nuts from one tree.

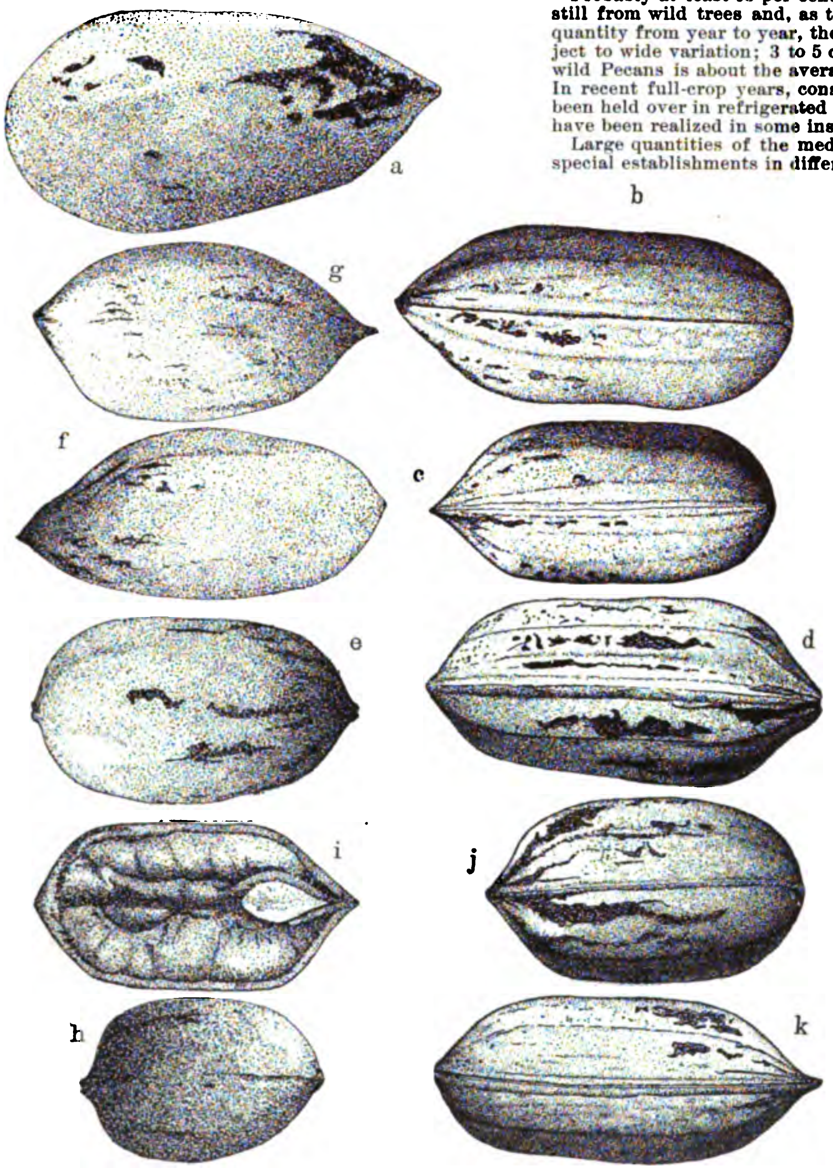
The most promising results in the top-working of Pecan trees that have yet been obtained are probably those of E. E. Risien, San Saba, Texas, who finds annular budding in June or July of strong shoots of the growth of the current season the best method. An abundant crop of such shoots is secured by cutting back the trees severely in March, using a cross-cut saw if necessary, as is sometimes the case on large trees. If the tree is old and the bark hard, the pushing of buds is stimulated by hacking the bark of the stubbed trunk and branches with a hatchet. The budding is done when the shoots attain the size of an ordinary lead pencil. Budding done on dry days is found to yield much the best results, especially if followed by several days of dry weather. The cions must be thoroughly protected against drying out between removal from the tree and budding, however; and the "tying in," for which strips of old cotton cloth are used in preference to stronger material, must be thoroughly done, to insure success. When all conditions are favorable, thrifty seedling trees are quickly transformed to choice varieties in this way, and begin to bear good crops within three or four years after the operation is performed. Fig. 1694 shows such a tree during the fourth season after budding. The tin guards about the trunks are found necessary in that section to protect both young nuts and tender shoots from destruction by squirrels during the summer.

Distance, Method of Planting, and Cultivation.—From its large size it is clear that the Pecan should not be crowded. Most of the orchards planted have been at distances of 40 or 50 feet, but experience would indicate that 60 feet is a safer distance. Where seedling trees are depended upon it is probably advisable to plant closer together on the start, with a view to cutting out the trees bearing inferior nuts as soon as their true character is discovered. As at least half of the seedlings of any given lot may be expected to yield nuts very much inferior in size to the seed planted, it is probably wise to plant about double the number that are desired as permanent trees. The subsequent thinning out will leave the trees irregularly placed, but until bud propagation of the species, both in nursery and orchard, is better understood and more successfully done than at present this is probably the safest and most economical method for the orchard planter to adopt. In the earlier days many planters advocated and practiced planting the nuts where the trees were to remain in the orchard, usually planting two or three in a place to insure a "stand." The difficulty of protecting the young trees from injury and the consequent uneven character of the orchards have caused most of the later plantings to be made from the nursery row at the age of one or two years. If planted on strong and well-prepared soil to insure a vigorous growth the first season after removal to the orchard, one-year-old trees are probably preferable. The tap-root of the one-year-old Pecan tree is usually two or three times as long as the top, and more care in digging from the nursery rows is necessary than with most trees. No harm will result from a moderate shortening-in of the tap-root, however. In fact, the tree is probably benefited by the more spreading root system that results from this practice.

If the nuts are to be planted either in nursery row or orchard they should, if of valuable varieties, be stratified in sand during the winter and planted out as early in spring as the ground can be worked. If of common sorts or in regions where mice and squirrels do not abound, they may safely be planted in well-drained soil before winter sets in. Ordinary nursery cultivation will usually suffice, but nothing necessary to insure a strong and vigorous growth the first season should be left undone. Digging from nursery row is most easily done with a horse tree-digger, which cuts the roots at a sufficient depth to avoid injuring the trees.

The soil for orchard planting should be thoroughly prepared, and, if not naturally rich, should be well fertilized with well-rotted stable manure or some fertilizer rich in available nitrogen. Much depends upon securing a strong growth of both root and top the first year after transplanting. If proper care is taken to cultivate and fertilize the trees they are probably not injured by cropping with ordinary hoed crops for four or five years, especially if occasional leguminous crops, like crimson clover, cow pea or velvet bean, are plowed in. After trees reach maturity in thrifty condition, cultivation is probably less important, though some of the most productive trees reported are in fields regularly planted with cultivated crops.

Harvesting and Marketing.—The common method of harvesting is to gather the nuts at intervals of a few days as they fall, sometimes hastening the dropping by beating the bunches lightly with bamboo or other light rods. The nuts should not be left on the ground long enough to become wet or discolored by storms, as both appearance and quality are injured thereby. Most Pecans of medium size, and below, are now polished by friction in revolving barrels before being placed with retail dealers. This process cleans and brightens the nuts, and renders them more attractive in appearance. Unfortunately, it has the same effect on stale nuts as on fresh ones, and makes possible the working off of old stock for new. Dealers have been quick to take advantage of this and frequently mix old polished nuts with new at the beginning of the season. It is therefore not advisable to polish or otherwise manipulate high-grade fresh Pecans at the present time. The demand for large, thin-shelled nuts for seed has consumed so large a proportion of the product up to the present time that market prices on large nuts for table use are hard to fix. For fresh nuts, running approximately 50 or less to the pound, the retail price is rarely below 50 cents per lb. in the large cities, while for seed, such nuts, if of well-authenticated varieties, usually bring from $1 to $2.50 per lb.



1696. Named varieties of the Pecan. Natural size.

Probably at least 95 per cent of the market supply is still from wild trees and, as the crop varies greatly in quantity from year to year, the wholesale price is subject to wide variation; 3 to 5 cents per lb. for ordinary wild Pecans is about the average price paid by buyers. In recent full-crop years, considerable quantities have been held over in refrigerated storage, and large profits have been realized in some instances in this way.

Large quantities of the medium sizes are cracked in special establishments in different cities, notably in San Antonio, Texas, and New York, and marketed in neat cardboard cartons in the form of meats ready for the domestic or commercial confectioner. Such meats usually retail at 50 to 60 cents per lb., and at a somewhat lower price their consumption will undoubtedly be largely increased.

Insect Enemies.—Among the most troublesome enemies of the Pecan are certain leaf-eating caterpillars, including the fall webworm (*Hyphantria cunea*, Drury), which is controlled by burning the webs with a torch attached to a pole as soon as it is discovered. Spraying with Paris green would doubtless be more effective in case this pest should appear in large numbers. The hickory twig-girdler (*Oncideres cingulatus*, Say) is sometimes troublesome on Pecan. The female beetle deposits her eggs in twigs which she afterwards girdles to such an extent that they are broken off by autumn winds and fall to the ground. These should be immediately gathered and burned, to prevent the larvæ from entering the ground. Certain borers, notably the painted hickory borer (*Cyllene pictus*, Drury,) and allied species, sometimes work havoc by tunneling the cambium layer and inner bark, but their attacks are believed to be confined to old or feeble trees. The hickory bark borer (*Scolytus 4-spinosus*, Say) also works upon trees that have lost their vitality through advanced age or other cause. The only known remedy for these is the prompt removal and destruction of infested trees as soon as discovered.

Probably the most serious insect enemy to the commercial Pecan-grower is the hickory-shuck worm (*Grapholitha caryana*, Fitch), the larvæ of which penetrate the hull and young nut, causing premature dropping. So far as recorded, it is less troublesome on Pecan than on the shellbark hickory (*H. laciniosa*) and its hybrids. No remedy except prompt destruction of the infested nuts by burning has been discovered.

Varieties (Fig. 1696).—Under the stimulus of the high prices paid for choice seed nuts of good reputation, many varieties of

Pecan, mostly selected wildlings, have been dignified by the application of names more or less appropriate, during the past ten years. In most instances these have been published with but brief and imperfect descriptions which do not serve to identify the varieties. As but a small proportion of them have ever been propagated by other means than by seed, the future production of nuts under these names may be expected to show great variation. The wisdom of applying varietal names to Pecans not propagated by some method of bud-propagation may well be questioned, as it is certain to result in a confused nomenclature when seedlings grown from them come into bearing. Out of more than 70 sorts that have been thus dignified with names it is very doubtful whether more than 20 have been offered by nurseries except in the form of seedlings. Of those that have been so propagated and are obtainable in southern nurseries, the following are probably the most important sorts. Little has yet been determined regarding their adaptability to other regions than those in which they originated. The price of trees ranges from 50 cents to $1.50 per tree for one- or two-year-old grafted or budded stock:

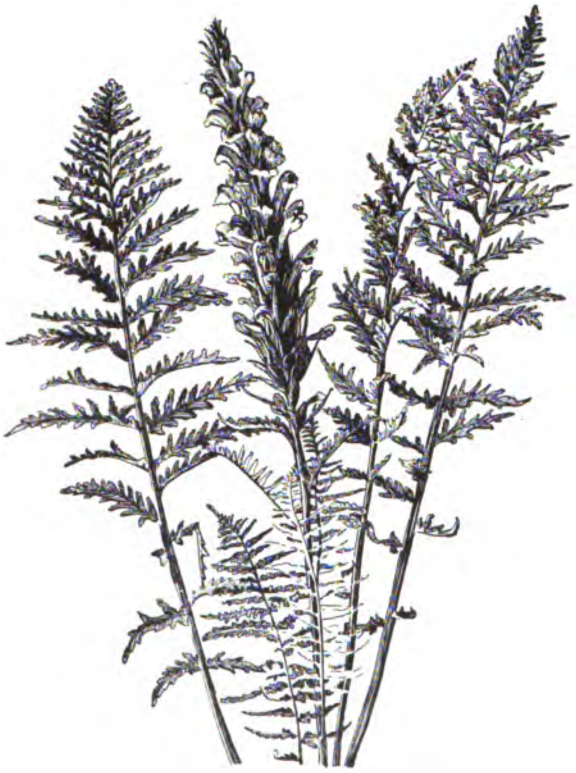
Century (Fig. 1696, *a*).—Introduced by Herbert Post, Fort Worth, Texas. One of the largest Pecans yet brought to notice, selected nuts measuring 2¼ x 3¾ inches in circumference, and running 25 to the pound.

Columbian (Fig. 1696, *b;* syns., Mammoth, Rome, Pride of the Coast).—Originated at Convent, La., and disseminated under the above names by different nurseries. Large, cylindrical, slightly constricted at middle and tapering at apex, which is frequently four-sided; shell moderately thin; of good cracking quality and delicate flavor. Tree reported to be vigorous, but irregular in bearing and yielding nuts varying greatly in size and plumpness of kernel.

Frotscher (Fig. 1696, *c*).—Originated at Olivier, La., and introduced by the late Richard Frotscher, of New Orleans. One of the largest and best in all respects. Nut cylindrical, tapering slightly; shell thin, parting easily from kernel, which with a little care can be removed entire; flavor delicate, quality excellent. Tree thrifty and productive.

Jewett (Fig. 1696, *d*).—Introduced by the late W. R. Stuart, Ocean Springs, Miss. Very large, oblong, often constricted and usually rather angular; shell of medium thickness, parting easily from kernel, which does not always fill well; quality very good.

Pabst (Fig. 1696, *e*).—Origin, Ocean Springs, Miss. Disseminated by Chas. E. Pabst, Ocean Springs, Miss. Cylindrical, moderately large; shell medium, parting well; kernel plump, bright and of excellent quality. Tree vigorous and productive.



1697. Pedicularis procera (× ⅓)

Paragon (Fig. 1696, *f*).—Introduced by Herbert Post, Fort Worth, Texas. Long-obovate, with pyramidal apex, large, with moderately thin shell, cracking well; kernel plump, but with rather deep convolutions; quality very good.

Russell (Fig. 1696, *g*).—Origin, Ocean Springs, Miss. Introduced by Chas. E. Pabst, Ocean Springs, Miss. Oval, pointed, medium to large in size, with very thin shell and plump, bright kernel; cracking quality excellent; flavor delicate, quality very good. Tree productive.

San Saba (Fig. 1696, *h*).—Origin, San Saba, Texas. Introduced by E. E. Risien, San Saba, Texas. Nut cylindrical, small to medium in size, with very thin shell, fine cracking quality, very bright kernel and delicate flavor. This little nut is of the highest quality for dessert use and but for its small size would be one of the most promising yet brought to notice.

Sovereign (Fig. 1696, *i*).—Origin, San Saba, Texas. A seedling of San Saba, grown and introduced by E. E. Risien, San Saba, Texas. Cylindrical, medium to large, with very thin shell and full kernel of fine quality. A new variety of much promise.

Stuart (Fig. 1696, *j*).—Origin, Pascagoula, Miss. Introduced by the late W. R. Stuart, Ocean Springs, Miss. Cylindrical, large to very large, selected nuts running 35 to the pound; shell moderately thin, cracking quality good; kernel plump, quality good. Tree thrifty and productive.

Van Deman (Fig. 1696, *k*).—Introduced by the late W. R. Stuart, Ocean Springs, Miss. Oblong, large, running 45 to the pound; shell moderately thin, cracks well and yields plump meats of good quality.

Hybrids.—Several evident hybrids of the Pecan with other species of Hicoria have been brought to notice, the most conspicuous being the McCallister (syn., Floyd) from southern Indiana, and the Nussbaumer from southern Illinois, both evidently hybrids between *H. Pecan* and *H. laciniosa*. Neither these nor others of similar character give promise of immediate cultural value, however.

For detailed descriptions of varieties and fuller discussion of Pecan, see Rept. on Nut Culture, Div. of Pom. U. S. Dept. of Agr., pp. 49–64, Pl. 4, 8, 9, Fuller's Nut Culturist, chapter on Hickory Nuts, pp. 147–202; Rept. Mo. Bot. Garden 7, pp. 28–42, Pl. 1–23. See *Hicoria*.

Wm. A. Taylor.

PEDICULÀRIS (Latin, *louse;* long supposed to breed lice in sheep that fed on these plants). *Scrophulariàceæ*. Lousewort. About 125 species of herbs, mostly natives of the northern hemisphere, with terminal spikes of yellow, reddish purple or white fls. The few kinds cult. in hardy borders are chiefly esteemed for the beauty of their fine-cut foliage. A good many species have been tried, but they seem to be short-lived and it is conjectured that their roots are more or less parasitic on other plants. A few are annuals or biennials, but the great majority, including those described below, are perennials. They are procurable from dealers in native plants. *P. Canadensis* seems to be the only American species cult. in European gardens. A good plant of it has 6–8 fls., each ¾ in. long, in a spike 1½ in. long, which becomes 5–8 in. long in fruit.

Generic characters: lvs. alternate or whorled, rarely subopposite, 1–many times pinnately divided, rarely merely dentate: calyx anteriorly cut, variously 2–5-toothed; corolla 2-lipped, the upper one (or galea) with or without a long beak: stamens 4, didynamous: capsule ovate or lanceolate, oblique: seeds usually few.

A. *Galea (upper lip of the corolla) with a long beak (½ in. long).*

racemòsa, Dougl. Height 1 ft.: lvs. undivided, minutely and doubly crenulate: fls. white; beak circinate-incurved, nearly reaching the lower lip. Colo. to Brit. Col.

AA. *Galea with very short beak or none.*

B. *Bracts mostly longer than the fls.*

pròcera, Gray. Fig. 1697. Robust, 1½–4 ft. high: lvs. pinnately divided: spike 6–15 in. long: fls. sordid yellowish and greenish striate. Mts. of Colo. and New Mex.

BB. *Bracts shorter than the fls.*

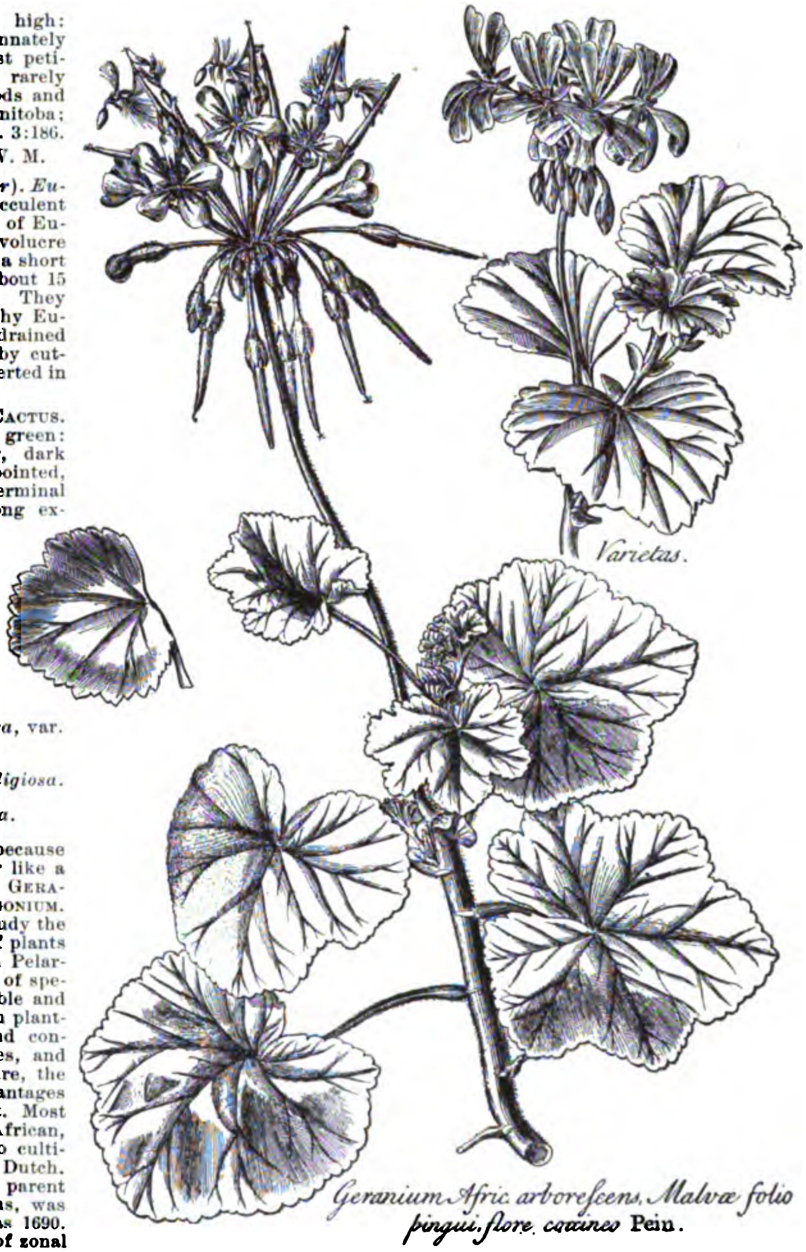
C. *Capsule ovate, scarcely longer than the calyx.*

lanceolàta, Michx. Swamp Lousewort. Glabrous or nearly so, 1–3 ft. high: lvs. alternate and opposite, pinnately lobed, upper ones sessile: fls. yellow. Aug.–Oct. Swamps, Conn. to Manitoba; south, Ohio to Neb. B.B. 3:185.

CC. *Capsule lanceolate, three times as long as the calyx.*

Canadénsis, Linn. Wood Betony. The common American Lousewort, usually more or less hairy: stems commonly tufted, ½–1½ ft. high: lvs. mostly alternate, pinnately parted, all but the uppermost petioled: fls. yellow or reddish, rarely white. April–June. Dry woods and thickets, Nova Scotia to Manitoba; south, Fla. to N. Mex. B. B. 3:186. B.M. 2506.

W. M.


Varietas.
Geranium Afric. arboreſcens, Malvæ folio pingui, flore coccineo Pein.

1698. Pelargonium inquinans (and a variety of it) as figured by Dillenius in 1732. One-half size of the original plate

PEDILÁNTHUS (*shoe-flower*). *Euphorbiàceæ.* Mostly small succulent shrubs, having the characters of Euphorbia, except that the involucre is irregular and enlarged into a short spur on the upper side. About 15 species in tropical America. They are easily grown with the fleshy Euphorbias in sandy loam, well drained and manured. Propagated by cutting dried at the base, then inserted in occasionally moistened sand.

tithymaloides, Poit. Bird Cactus. Jew Bush. Stem 4–6 ft. high, green: lvs. lanceolate, 1–3 in. long, dark green: involucres bright red, pointed, declined, ½–¾ in. long, in terminal cymes: stamen and style long exserted. West Indies. B.R. 10:837. L.B.C. 8:727 (*Euphorbia canaliculata*). B.M. 2514 (*Euphorbia carinata*).

P. mácropus, Benth., with whitish stems and minute leaves, from Calif., is occasionally cultivated.

J. B. S. Norton.

PEEN-TO, or **Flat Peach** of the South is *Prunus Persica*, var. See *Peach* and *Prunus*.

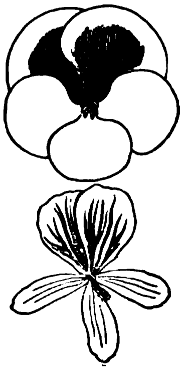
PEEPUL TREE. *Ficus religiosa.*

PEIRÉSKIA. See *Pereskia*.

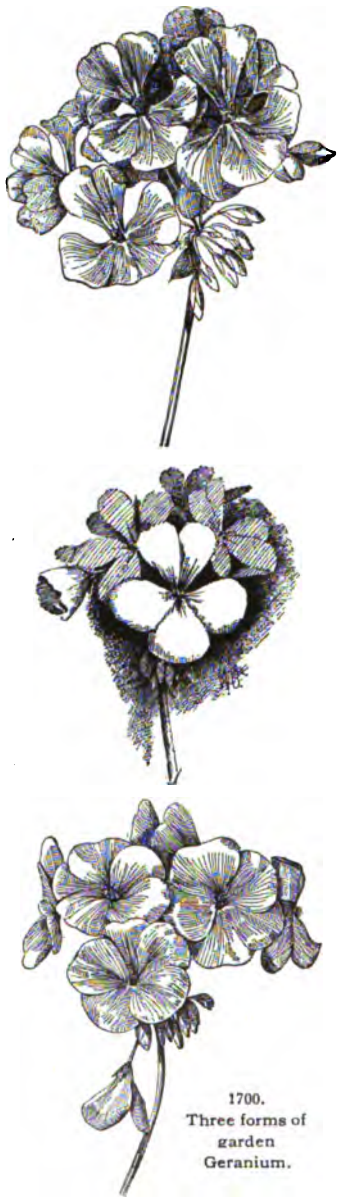
PELARGÒNIUM (*stork*, because the fruit is long and slender like a stork's bill). *Geraniàceæ.* Geranium of gardens. Pelargonium. The person who wishes to study the contemporaneous evolution of plants may find his heart's desire in Pelargonium. With great numbers of species and many of them variable and confusing in a wild state, with plant-breeding in many places and continued through two centuries, and with a large special literature, the genus offers exceptional advantages and perplexities to the student. Most of the species are South African, whence they early came into cultivation by the English and Dutch. *P. cucullatum*, the dominant parent in the florist's Pelargoniums, was known in England as early as 1690. The two originals of the race of zonal or bedding Geraniums were introduced into England in 1710 and 1714. Early in that century, a half dozen species were grown at Eltham, in the famous garden of James Sherard, and these were pictured in 1732 in Dillenius' account of that garden, "Hortus Elthamensis," a sumptuously illustrated work in quarto. Even at that time, *P. inquinans* had varied markedly (see Fig. 1698). In his "Species Plantarum," 1753, Linnæus described the few species which he knew (about 25) under the genus Geranium. In 1787, L'Heritier founded the genus Pelargonium, and transferred many of the Linnæan species. L'Heritier's work "Geraniologia," a quarto, appeared in Paris in 1787 to 1788, with 44 full-page plates. Early in the nineteenth century, many species were in cultivation in Europe, and experiments in hybridizing and breeding became common. There seems to have been something like a Geranium craze. The experiments seem to have been confined chiefly to the development of the show or fancy Pelargoniums, as greenhouse subjects. The Geranium interest seems to have culminated in Robert Sweet's noble work on "Geraniaceæ," published in five volumes in London, 1820 to 1830, containing 500 well-executed colored plates of geraniaceous plants. At that time many distinct garden hybrids were in cultivation, and to these Sweet gave Latin botanical names. His fifth volume is devoted chiefly to garden forms of the show Pelargonium type, to which the name *P. domesticum* is given in the following sketch. The development of the zonal or bedding Geraniums had begun in Sweet's time, and he includes them in his pictures, but the larger part of their evolution is subsequent to his history. Various small works on Pelargonium have appeared. De Jonghe's "Traité Méthodique de la Culture du Pélargonium," Brussels, 1844, contains good bibliographical and cultural data.

Most of the cultivated forms of Pelargonium can be grouped into four general horticultural classes:

I. The zonal, horse-shoe, fish, or bedding types, known to gardeners as Geraniums. They comprise a mongrel class, lately designated (Bailey, "Botany," p. 314) as *Pelargonium hortorum*. This race seems to be derived from *P. zonale* and *P. inquinans*. These species were made by Linnæus in 1753, but he founded them on descriptions in earlier works rather than directly on the plants. In America, the zonal Geraniums are very popular, for they develop their colors well in the bright climate. They are popular in all countries, however. They probably stand closer to the lives of a great number of people than any other ornamental plant. If a window or a garden can have but one plant, that plant is likely to be a Geranium. The old race of large-flowered and large-clustered Geraniums was known as Nosegay Geraniums, because they were bouquet-like, but this term is not known in America. Another race has been developed for its zone-marked leaves. There is also a race of double-flowered zonals, which have appeared chiefly since 1860. The very full double and close-clustered forms lose much of the grace and charm of the single types. Some of them are little better, to a sensitive eye, than balls of colored tow or wadding. In the development of the individual flower of the Geranium, there have been two ideals—the English ideal for a circular flower with the petals broadened and overlapping, and the continental ideal with a somewhat 2-lipped flower and the petals well separated. In the Gardeners' Chronicle in 1841, p. 644, the proper form is set forth in an illustration, and this is contrasted with the "original form;" the picture is reproduced, somewhat smaller, in Fig. 1699. "The long, narrow, flimsy petals of the old varieties," the writing says, "moved by every breath of wind, and separated to their very base by broad, open spaces, have been succeeded by the beautiful compact flowers of the present day, with broad stout petals so entirely overlapping each other as to leave scarcely an indentation in the outline of the flower; while the coarseness which prevailed in the larger of the old sorts is replaced by a firmer substance, and a far more delicate texture." Fig. 1700 shows contrasting ideals, although the picture does not represent the extremes.



1699. Gardener's ideal, and the original form, as depicted in 1841.



1700. Three forms of garden Geranium.

The upper two show the 2-lipped ideal. Uppermost is Mrs. E. G. Hill; middle one, Maculatum; lowest, Wistre.

In recent years a French type has appeared under the name of "gros bois," or "large-wood" race. It is characterized as follows by Dauthenay: umbels ordinarily 4–5 in. in diam.: fls. very large; petals roundish, or sometimes triangular, the limb always very large and giving the corolla a remarkably round contour: lvs. very large, thick and coriaceous, plane or incurved, more or less indented, strongly nerved, their diam. averaging about 5 in.: pedicels large and short: peduncles large, rigid, and projecting beyond the foliage: wood soft, fleshy, very large, often 1½ in. around. To this type Dauthenay refers the Bruant Geraniums, dating from 1882.

A special handbook is devoted to those plants: Dauthenay, "Les Géraniums," Paris, 1897.

II. The ivy-leaved Geraniums, the products of *Pelargonium peltatum*. Fig. 1702. The species is said to have been introduced into England in 1701. It is a weak and straggling plant, used mostly in vases, hanging baskets, and other places in which an overhanging subject is desired. The foliage is thick and shiny, slightly peltate and prominently angle-lobed, and the pink or reddish 2-lipped flowers are always admired. Much-improved and double forms are now in commerce, and the plant is probably more popular than at any time in its history.

III. The show or fancy type is known to gardeners as Pelargonium, and in this country also as Lady Washington Geraniums. Fig. 1705. These plants are very popular in Europe, being grown in numerous varieties. They are prominent at the exhibitions. Because of the hot, trying summer climate, these plants are of very secondary importance in America, although there are many gardeners who succeed well with them. This race of Pelargoniums seems to have descended chiefly from *P. cucullatum*, although *P. angulosum* may be nearly equally concerned in it. *P. grandiflorum* is also thought to have been a formative parent. It is probable that two or three other species are concerned in the evolution. In fact, the late Shirley Hibbard once wrote (G.C., July 3, 1880) that "it must be evident to every cultivator of these flowers that the blood of a score or so of species is mingled in them." This marked garden race, which represents no single wild species, is designated below as *P. domesticum*.

IV. Various scented-leaved Geraniums, known mostly as Rose Geraniums. These are of several species, with their hybrids and derivatives. The common Rose Geraniums are nearest *P. graveolens* and *P. Radula*. The Nutmeg Geranium is *P. odoratissimum*.

Aside from the above groups there are several species which appear sporadically in the trade, as *P. tomentosum*, *P. echinatum*, *P. triste*, *P. quinquevulnerum*, *P. fulgidum* and *P. quercifolium* or the derivatives of each. The other species mentioned in the following account (and not mentioned above) are not known by the writer to be in the American trade, but they are of interest as parents of garden forms or for other special reasons. Many of the true species of Pelargonium are very satisfactory plants, and they deserve to be better known. Few great collections of Pelargonium species and varieties have been made in this country. The late John Saul, Washington, once had a very large collection. Robert Sandiford, Mansfield, Ohio, is a prominent grower of the zonal and ivy-leaved class; also the Cottage Gardens, Queens, N. Y., and E. G. Hill & Co., Richmond, Ind. John H. Sievers, San Francisco, has a large collection of the Lady Washington class. The Horticultural Department of Cornell University has had about 1,000 varieties and species, representing all groups.

Bentham and Hooker estimate that the genus Pelargonium contains about 170 species. Nearly all of them are from South Africa. All the species mentioned in this article are from that region. Harvey, in Vol. I of Harvey & Sonder's Flora Capensis (1859–60), admits 163 species; and his descriptions are followed closely in the characterizations of species given below. Pelargonium is distinguished from the genus Geranium by technical characters. In most cases, the flowers of Geranium are regular, but those of Pelargonium are irregular, the two upper petals differing from the others in size and shape and often in coloring. The most constant difference between the two genera is the presence in Pelargonium of a nectar-tube, extending from the base of one of the sepals and adherent to the side of the calyx tube or pedicel. This tube is not seen by the casual observer, but it can be discovered by making a longitudinal section of the flower and pedicel. In Pelargonium the calyx is 5-parted; petals 5, mostly obovate or spatulate, in 2 sets or series comprising 2 upper and 3 lower; stamens really 10, but 3 or more of them merely sterile filaments.

L. H. B.

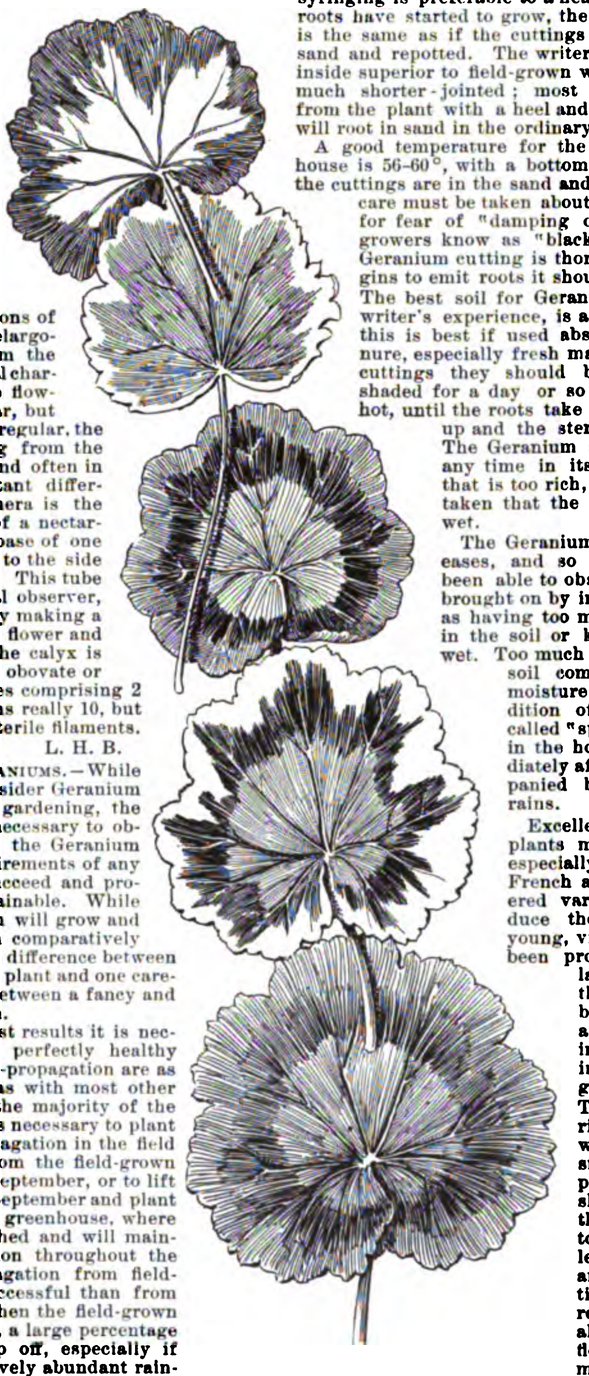
Culture of Zonal Geraniums.—While the general florist may consider Geranium culture the easiest of all gardening, the fact remains that it is as necessary to observe the requirements of the Geranium as it is to observe the requirements of any other plant, in order to succeed and produce the best effects attainable. While it is true that the Geranium will grow and make a good showing with comparatively little care, there is as much difference between a skilfully grown Geranium plant and one carelessly grown as there is between a fancy and a common rose or carnation.

In order to secure the best results it is necessary to propagate from perfectly healthy stock. The dangers of over-propagation are as great with the Geranium as with most other plants. In order to keep the majority of the varieties in good health it is necessary to plant the stock intended for propagation in the field and to propagate either from the field-grown wood in August or early September, or to lift the plants in the month of September and plant them on benches in the greenhouse, where they will become established and will maintain a vigorous constitution throughout the winter season. The propagation from field-grown wood is far less successful than from wood grown inside, and when the field-grown cuttings are placed in sand, a large percentage of them is likely to damp off, especially if there has been a comparatively abundant rainfall during the month of July. The best method that the writer has found for striking the field-grown cuttings is to put them in 2-inch pots, using a light, sandy soil free from all manure and chemicals, and to place the pots in the full sunlight either in a coolhouse or a frame. These cuttings must be kept on the dry side until the calluses have been well formed, although they should not be allowed to shrivel at any time. If the cuttings show signs of shriveling, a light syringing is preferable to a heavy watering. After the roots have started to grow, the treatment of the plants is the same as if the cuttings had been rooted in the sand and repotted. The writer considers wood grown inside superior to field-grown wood, as the cuttings are much shorter-jointed; most of them can be taken from the plant with a heel and 95–100 per cent of them will root in sand in the ordinary cutting-bench.

A good temperature for the Geranium propagating house is 56–60°, with a bottom heat of 65–68°. While the cuttings are in the sand and before they are rooted, care must be taken about keeping them too moist for fear of "damping off," or what Geranium growers know as "black rot." As soon as the Geranium cutting is thoroughly callused and begins to emit roots it should be potted up at once. The best soil for Geraniums, according to the writer's experience, is a firm, pliable clay loam; this is best if used absolutely without any manure, especially fresh manure. After potting the cuttings they should be lightly watered and shaded for a day or so if the sun is extremely hot, until the roots take hold and the foliage fills up and the stems begin to look plump. The Geranium should not be grown at any time in its young state in a soil that is too rich, and care must also be taken that the plants are not kept too wet.

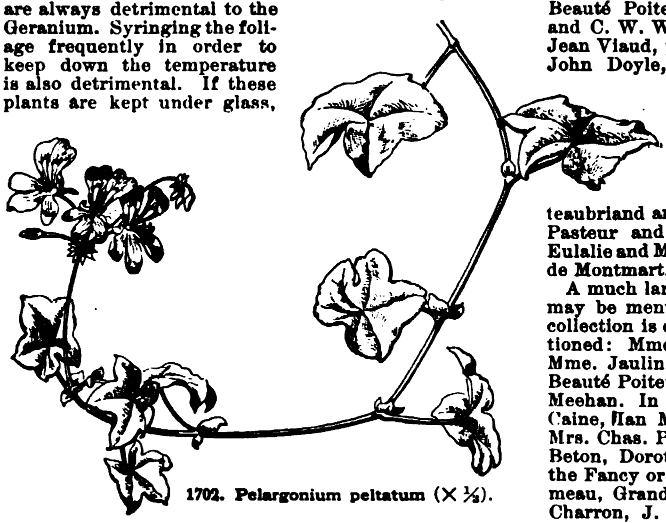
The Geranium is subject to few diseases, and so far as the writer has been able to observe these diseases are brought on by improper treatment, such as having too much fresh rank manure in the soil or keeping the plants too wet. Too much strong plant-food in the soil combined with too much moisture produces a spotted condition of the leaves ordinarily called "spot." It usually appears in the hottest weather or immediately after extreme heat accompanied by copious showers or rains.

Excellent specimen Geranium plants may be grown in pots, especially of some of the newer French and English round-flowered varieties. In order to produce the best results, select young, vigorous plants that have been propagated either in the latter part of August or the fore part of September, and that have shown a disposition to take hold immediately, both in rooting and in starting to grow after being potted. The soil should not be too rich, and it is best to start with the plant in a rather small pot, say 2½ in., and proceed onward with light shifts,—that is, shifting the plant from a 2½-in. to a 3½-in. pot, and so on, letting the sizes increase an inch at each shift until a 7-, 8- or 9-in. pot is reached, which will usually be large enough to flower the finest specimens. Whenever potting the Geranium, be sure to pot firmly, as a firm soil produces a short-jointed, stocky growth, and far more bloom than a loose or over-rich soil. When the plants reach a 5- or 6-in. pot they may be regularly fed with manure water. The most



1701. Leaves of various fancy-leaved Geraniums—P. hortorum (× ⅛).

critical time for these specimen Geranium plants will be during the months of July, August and September; during these periods exposure to intense sunshine should be avoided. Too much water and a close temperature are always detrimental to the Geranium. Syringing the foliage frequently in order to keep down the temperature is also detrimental. If these plants are kept under glass, a light shading or stripping upon the glass is beneficial. Probably the best position for such plants during these three extreme months is on the north side of a row of trees, some distance away from the trees, where the plants will have the benefit of the subdued shading of the foliage. If kept under glass and shaded, abundant ventilation should always be provided. As the winter approaches, a night temperature of 60° and day temperature of 70°-75°, with plenty of ventilation during the daytime, especially in bright weather, seems to best suit the plants. Syringing ruins the flowers, and too much moisture either in the pot or upon the foliage causes the spotting of the foliage known as "dropsy." In planting the Geranium in the field or in beds always avoid an over-rich soil. The soil should be in good condition and fertile, but must not be loaded with either chemical or animal fertilizer. Too much water at any period during the hot weather produces a rank growth, reduces the quantity of bloom and in the majority of instances causes the spotted foliage to appear.



1702. Pelargonium peltatum (X ⅓).

Another disease, which is sometimes serious, especially in extremely hot seasons accompanied with a superabundance of moisture, is "stem rot." This frequently attacks imported stock. Just what produces this disease the writer is unable to say, but it is most serious during intensely hot seasons; the entire plant turns black and fades and withers away. The stem rot occurs in varieties that have been very heavily propagated.

The insects that affect the Geranium are also comparatively few. The red spider is sometimes a serious pest during the summer and is difficult to get rid of when it is once well established. The only method that the undersigned has found efficacious is to syringe the plants with an extremely fine spray, and also to pick off the leaves that are seriously affected and burn them. The greenfly is also troublesome at times, but is easily managed with the ordinary fumigation of tobacco. There is a small caterpillar that eats the foliage and sometimes proves a serious pest. If one can induce a few ground sparrows or any of the warblers, or even English sparrows, to make their home in the greenhouse, they will put a speedy end to these caterpillars. Another remedy is to go over the plants carefully and pick the caterpillars off and destroy them. This is tedious, as it must be done frequently.

In the way of bedding Geraniums, as a rule the Bruant section produces the best results, but there are a number of English and French varieties that do especially well in our hot climate. The greatest difficulty that we have in successful Geranium culture in America is the intense heat of the summer months, chiefly July and August. The writer has found that the following varieties grow especially well in the field as well as in beds on lawns. In the Bruant section: Mme. Landry, Beauté Poitevine, Mme. Charotte, Mme. Chas. Molin, and C. W. Ward, all of varying shades of salmon-pink; Jean Viaud, pure clear pink; Mme. Jaulin, peach-pink; John Doyle, A. Riccard and General Grant, scarlet; Thos. Meehan, magenta-pink; Count de Castellane, a deep crimson-scarlet. Among the French varieties: Mme. Barney, Mme. Philip La Brie and Francis Perkins, pure pink; Rene Bazin, bright rosy salmon; Gertrude Pearson and Grandville, pure pink; Marvel, S. A. Nutt, Richelieu, Chateaubriand and De La Vigne, brilliant crimson-scarlet; Pasteur and John P. Cleary, bright orange-scarlet; Eulalie and Mme. Buchner, snow white; Cæsar and Duke de Montmart, brilliant aniline-purple.

A much larger list of varieties suitable for pot culture may be mentioned, for when growing in pots a larger collection is desirable. Among the Bruants may be mentioned: Mme. Charotte, Jean Viaud, Mme. Landry, Mme. Jaulin, Mme. Chas. Molin, Count de Castellane, Beauté Poitevine, Mme. des Bordes Valmore, and Thos. Meehan. In the English round-flowered section: Hall Caine, Ian Maclaren, Wm. Ewing, Gertrude Pearson, Mrs. Chas. Pearson, Barbara Hope, Lillian Duff, Mary Beton, Dorothy Burroughs, and Rudyard Kipling. In the Fancy or Aureole section: Andrew Lang, Jean Remeau, Grandville, La Fraicheur, Mark Twain, Hubert Charron, J. B. Varrone, Mme. Bruant, Mme. Blanche Jamet, George Sand and Daumier, crimsons and scarlets; Rasphail Improved, John P. Cleary, Richelieu, Chateaubriand, Dr. Despres, Ryecroft Pride, Pasteur; in salmons, Modesty, Nydia and in purple Duc de Montmart.

C. W. Ward.

Show Pelargoniums.—What we know as show Pelargoniums have enjoyed a long popularity. By the general public, and by old people especially, they are known as Lady Washington Geraniums. They are not so commonly grown as Geraniums, chiefly on account of their limited season of bloom and the fact that they cannot endure our hot midsummer suns. Through the greater part of the summer they are liable to be neglected. They also require different treatment from Geraniums, and—if skill there be—more skill in cultivation.

We will commence at the end of the blooming season. They are past, and require rest,—a season of ripening the growth already made. During this time very little water will be needed, and they may be stood out in the full sun. We need only cut off the old flower-stems. In no sense should they be cut back at this time, neither should water enough be given to encourage new growth. All the leaves should stay on until they naturally turn yellow with age, thus securing a thoroughly ripened growth. In September, one may prune them into shape; sometimes rather severely, but in any case cut out all weak and soft shoots. They should then be shaken out

1703. A good Pelargonium (X ⅙). *P. cordatum* of botanists or an offshoot of that species.

and repotted in a light compost, not rich, into the smallest sized pots that will hold them, for the process of growing them on has to be gone over every season. After potting, a good soaking will be necessary, and they may be placed in a well-lighted coldframe. There is no need to keep them close; the stimulation of water, and the slight protection of a frame being usually enough to start them into new growth. No forcing will ever be needed at any season, and if one wished he might keep them in a coldframe until very late in the season, so long as adequate protection against frost is afforded. With us they are at their best in late May and June, and to have them in good condition we grow them slowly in a house averaging about 50° night temperature (slightly less in midwinter), from October onward.

After the turn of the days—in January—we repot them, using now a richer compost. We give a fairly good shift, depending in part on the size of plants desired, the vigor they show, and the difference in varieties. If we had wanted them to bloom in April or, as some florists might, at Easter, we should have potted them at once—in late August or September, into the size they should bloom in,—a medium size, probably the same as they had lately occupied, and have taken them indoors to grow on continuously. But for our display, in May and June, they are potted again in January, and some may be given another shift when extra vigor or the possible need of a few extra large specimens demand it. They will need careful stopping. Some rubbing out of weak shoots, when they break abundantly, will help those that remain, and we may even have to do a little pruning. Stopping, however, must be discontinued as soon as the flowering stems begin to show, which is about the end of February in the writer's practice. These stems can be distinguished easily by a slightly different manner of growth. Up to this time the plants may be allowed to grow naturally; but if we want trained specimens we must begin to bend them as we wish them to grow, as their growth speedily hardens and the plant will readily take and keep the form to which it is shaped.

Water should be given sparingly through the dead of winter. February and March are the months when the most growth is made, and at this time we can stimulate them materially by the judicious use of artificial manures, which may, if necessary, be continued until they come into bloom. They are much subject to the attacks of greenfly and red spider; and as the foliage is fairly tender and liable to injury from tobacco smoke, we are compelled to rely upon fluid insecticides almost wholly The blooming season is very much lengthened by giving a slight degree of shade.

The best time to take cuttings is soon after the flowering season. Often towards the last of the season, the plants make a few "growing" shoots, and these we take; but off and on during the summer we can get cuttings, and any time until August will do. Cuttings taken during winter time with a heel make pretty little plants in 4- or 5-inch pots without stopping. Cuttings taken at the usual time and grown on in 6- or 7-inch pots come in handy in grouping for the front lines. It is necessary to raise a few plants every season to replace older plants which have grown too large. New varieties are raised from seed, which is freely produced. In hybridizing it does not appear that hand-pollination has any effect, as the seedlings seldom show any particular affinity to either parent.

There is a dwarf strain of show Pelargoniums known as "fancy." The plants are usually heavily blotched and very free-blooming. The writer has never seen any in this country.

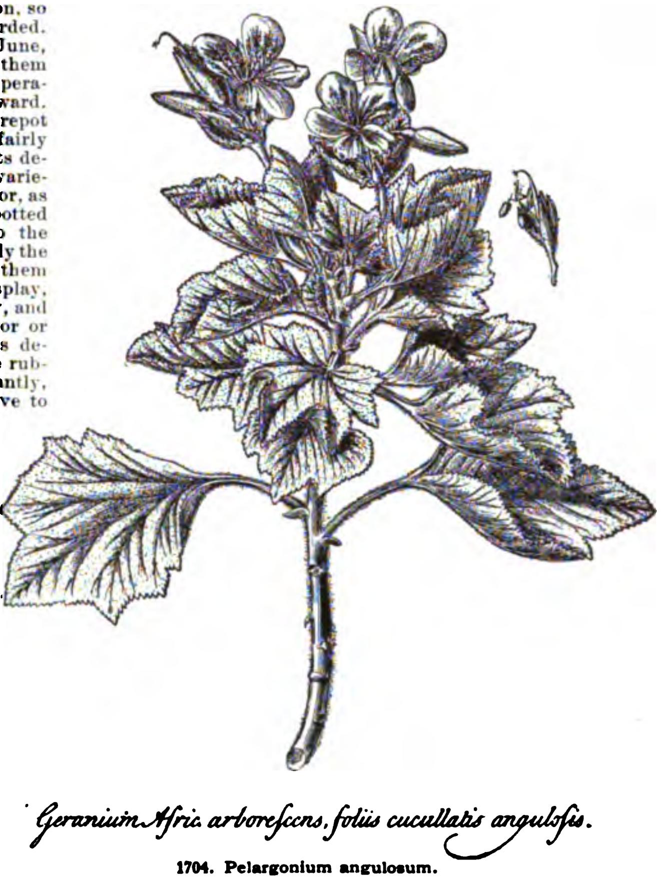
T. D. Hatfield.

INDEX TO THE SPECIES NAMES.

angulosum, 8.
betulinum, 5.
capitatum, 11.
cordatum, 6.
crispum, 17.
cucullatum, 7.
denticulatum, 16.
domesticum, 9.
echinatum, 20.
exstipulatum, 19.
fragrans, 21.
fulgidum, 24.
grandiflorum, 10.
graveolens, 14.
hortorum, 3.
inquinans, 2.
Limonium, 18.
odoratissimum, 21.
peltatum, 4.
quercifolium, 13.
quinquevulnerum, 23.
Radula, 15.
tomentosum, 12.
triste, 22.
zonale, 1.

A. *Plant with thick, succulent branches, and strong fishy odor: lvs. orbicular or reniform, shallowly if at all lobed: inflorescence umbellate: good stamens 7, the 2 upper ones short.* (*Ciconium.*) Fish or Bedding Geraniums.

1. **zonale**, Willd. Zonal, or Horse-shoe Geranium. Shrubby in its native place and in warm countries, becoming woody at the base even in pots, the young branches somewhat hispid: lvs. round-cordate, glabrous or pubescent, long-stalked, usually with a zone or horse-shoe mark of deeper color on the upper surface, the margin crenate-dentate, with several very shallow rounded lobes: stipules broad, cordate-oblong: peduncles long, the fls. nearly sessile: calyx-tube glabrous or nearly so, 4–5 times longer than the lanceolate segments; petals separated, narrow-wedge shape or spatulate.—"Among shrubs and on hillsides. . . . The flowers vary from scarlet and crimson through all shades of red to pure white."—*Harvey*. Probably originally red. *P. zonale* was introduced into England in 1710. Linnæus described it in 1753 as *Geranium zonale*, founding the species on previous descriptions, not on specimens. It is probable that the species had been considerably modified by domestication when Linnæus wrote. There seems to be no accepted portrait of the original form of the plant.


Geranium Afric. arboreſcens, foliis cucullatis anguloſis.

1704. Pelargonium angulosum.
From Dillenius' figure in 1732. One-half the size of the original plate.

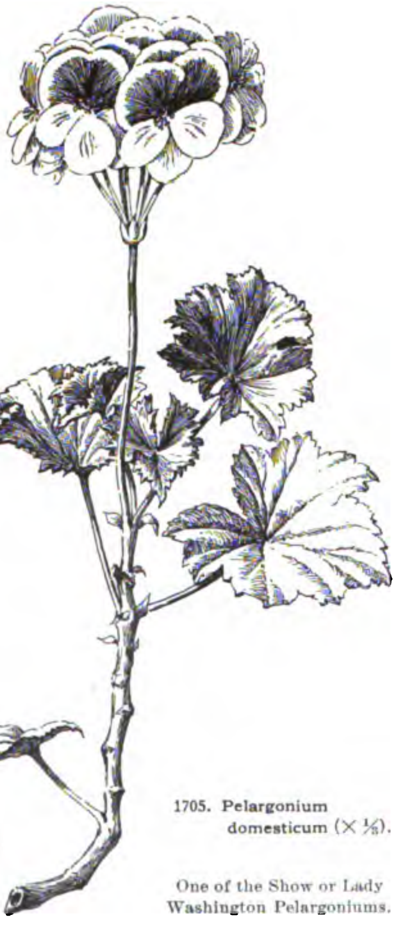
2. **inquinans**, Ait. Fish Geranium. Fig. 1698. Plant more velvety than *P. zonale*, sometimes more or less viscid, the leaves not zoned: calyx-tube densely glandular and viscid, 3–4 times longer than the lanceolate segments; petals broadly obovate, scarlet, but now varying to lighter colors.—"Among shrubs and on hillsides." This is the *Geranium inquinans* of Linnæus,

who founded the species on previous descriptions. One of the descriptions (Dillenius, in "Hortus Elthamensis," 1732) was accompanied by a picture, and this picture, reduced one-half, is reproduced in Fig. 1698. It will be seen that even in that early day the species had varied into a form with short-notched petals and short pedicels. Introduced into England in 1714.

3. **hortòrum**, Bailey. COMMON FISH or BEDDING GERANIUM. Figs. 1699–1701. The common Geranium in great numbers of forms, derived from the blending of *P. zonale* and *P. inquinans* in more than a century of careful selection. The original species are not now in cultivation. Practically all garden Geraniums have the zonal marks on the leaves or bands or a central blotch of variegation. Some of them have intermingled colors of green, white and red on the same leaf. Some are "silver-banded" and some "gold-banded." See Fig. 1701.

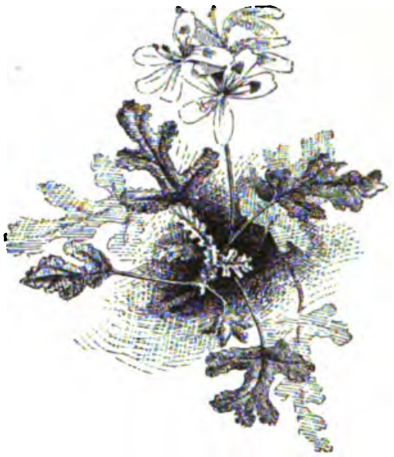
AA. *Plant weak and usually trailing, the branches slender and not succulent: lvs. fleshy and glossy, lobed, marginally peltate: inflorescence umbellate: good stamens 7, 2 upper shorter.* (*Dibrachya.*) IVY-LEAVED GERANIUMS.

4. **peltàtum**, Ait. (*P. scutàtum*, Sweet. *P. hederæfòlium*, Hort.). Fig. 1702. Plant with slender-jointed, more or less zigzag stems which are glabrous or very nearly so (except at the top): lvs. glabrous or minutely pubescent, fleshy, the petiole inserted just inside the margin at the base, about 5-nerved, with about 5 short wide, mostly obtuse main lobes and often with smaller minor lobes or angles and notches: peduncle very long, originally 4–8-fld., but now bearing many greatly modified fls., the calyx-tube slender and stalk-like and often longer than the pedicel and 2–3 times longer than the pointed nerved and mostly ciliate lobes; petals twice as long as calyx-lobes, red to white or purplish, the 2 upper ones erect and purple-blotched or striped, the 3 lower ones usually smaller and not marked and separated from the upper as if the flower were 2-lipped. B.M. 20. — Parent of the Ivy-Leaved Geraniums, now much improved and varied. Prized for baskets. There are forms with double fls. and colors of various kinds. It is a most desirable plant and very floriferous in most of the garden sorts.



1705. Pelargonium domesticum (× ⅓).

One of the Show or Lady Washington Pelargoniums.



1706. Pelargonium quercifolium (× ½).

AAA. *Plant woody, not succulent, the foliage often scented but not "fishy:" lvs. various, but not distinctly pinnately parted: inflorescence paniculate or umbellate: good stamens 7 or 6.* (*Pelargium.*)

B. *Stipules present and conspicuous.*

C. *Lvs. not distinctly lobed, though often angled, mostly oval or ovate and cordate. Exceptions in P. domesticum.*

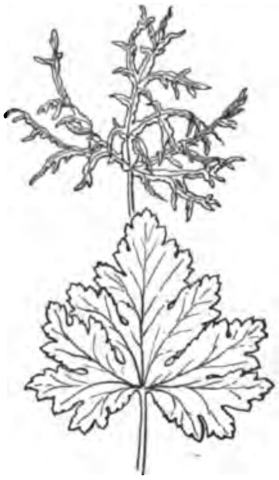
5. **betulinum**, Ait. Erect and shrubby, downy only on the young growths: lvs. stalked, oval or ovate, obtuse or not prominently acute, rounded or truncate at base, the stipules sharp and deciduous: fls. light purple, the broad upper petals with dark streaks. B.M. 148.—A handsome and neat plant.

6. **cordàtum**, Ait. Fig. 1703. Shrubby and erect, villous or nearly glabrous: lvs. long-stalked, cordate-acute, denticulate and sometimes obscurely lobed: peduncles usually branched, the pedicels and calyx soft-hairy: fls. purplish, the petals twice as long as the sepals. B.M. 165 (as *P. cordifolium*).—Told from *P. cucullatum* by its flat cordate-acute lvs. It is a handsome plant in bloom. The plant in cultivation as *P. cordatum* (Fig. 1703), has leaves more truncate at the base than the descriptions and old pictures call for, although on some shoots the leaves may be typically cordate.

7. **cucullàtum**, Ait. Tall and shrubby plant, much branched, softly and densely villous: lvs. long-stalked, kidney-shaped and cupped or cucullate, denticulate, very soft-pubescent, the stipules ovate-acute and withering: fls. purple, in many-fld. panicles, the pedicels and calices densely silky-hairy, the petals twice as long as the lance-acuminate sepals.—"Very common round Capetown and in the western districts, where it is often used as an ornamental hedge-plant."—*Harvey.* Known in England from 1690, and the parent, with *P. angulosum* and probably others, of the fancy or show Pelargoniums of gardeners. Not known in cult. in its pure or original form.

8. **angulòsum**, Ait. Fig. 1704. Differs from *P. cucullatum* in its harsh-hairy covering and rigid angled leaves: the lvs. are short-stalked, truncate or broadly cuneate at base, with 3–5 shallow angular and acute short lobes; panicles with fewer-fld. umbels.—Linnæus

included this plant in his *Geranium cucullatum*, but Aiton separated it as a distinct species. Linnæus' *G. cucullatum* was founded on literature. One of his sources of information was Dillenius' "Hortus Elthamensis," with a picture; but this picture, which is reduced one-half in Fig. 1704, is what is now known as *P. angulosum*. This is one of the species which has entered largely into the Pelargoniums of florists.


1707. Pelargonium Radula (above) and P. graveolens (× ⅛).

1708. Pelargonium denticulatum. (× ⅛.)

9. **domésticum.** Common, Show, Fancy and Lady Washington Geraniums (or Pelargoniums). Fig. 1705. The writer proposes this name for the garden type of fancy Pelargonium. The race is said to be derived chiefly from *P. cucullatum*, *P. angulosum* and *P. grandiflorum*, but the writer can see little evidence of the blood of *P. grandiflorum*. It seems to be nearest to *P. cucullatum*, having the cucullate or disk-shaped not lobed lvs. and mostly the soft-hairiness of that species. In many of them, however, the leaves are distinctly angle-lobed, suggesting *P. angulosum*. It is a fair question whether *P. cucullatum* and *P. angulosum* are themselves to be considered specifically distinct. *P. domesticum* is meant to comprise the whole range of garden forms of the Show or Lady Washington Pelargoniums. The name will enable one to talk about these garden plants with precision. To many of these garden forms specific botanical names have been given, so that *P. domesticum* is not the first name that has been applied in this group, but the writer is not aware that any collective or group name has been given. Sweet, in particular, has given Latin names to various forms. These old names, however, apply to particular historical forms, and it would be violence to enlarge their application to cover the entire group, and it would be difficult to select any one of them as more applicable, under botanical rules, than others. It is also inaccurate to call this garden form either *P. cucullatum* or *P. angulosum*.

cc. *Lvs. sharply 3–7-lobed and sharply toothed or serrate.*

10. **grandiflòrum,** Willd. Shrubby, glabrous and glaucous: lvs. long-stalked, strongly 3–7-nerved from the top of the petiole, deeply 5–7-lobed, the lobes broad and sharp-toothed, the stipules ovate and mucronate: fls. about 3 on each peduncle, the stalk-like calyx-tube 3–4 times as long as the lanceolate segments, the obovate white petals (upper 2 with red lines) 3 times as long as calyx-segments.—A handsome and distinct species, not now in cult. in its pure form.

11. **capitàtum,** Ait. Stems weak and trailing, with long white hairs, woody at the base: lvs. long-stalked, cordate, 3–5-lobed and the lobes rounded and toothed: peduncles longer than the lvs., densely many-fld., the fls. sessile, rose-purple, with calyx-tube much shorter than the hairy mucronate calyx-lobes.—Plant rose-scented, but not in general cultivation in its pure form.

ccc. *Lvs. cordate-lobed, soft and velvety.*

12. **tomentòsum,** Jacq. Plant rather thick- and soft-stemmed, long white-hairy all over: lvs. very long-stalked, very broadly cordate-ovate, 3–5–7-lobed and small-toothed, soft and velvety: stipules ovate-acuminate, withering: fls. small, white, with red near the center, in a lax panicle.—Scent like peppermint, and for that reason it is somewhat grown. The stems are long and straggly.

cccc. *Lvs. deeply several–many-lobed, with narrow divisions rather rough or stiff, strong-scented.* Rose Geraniums.

13. **quercifòlium,** Ait. Oak-leaved Geranium. Scarlet-flowering Rose Geranium. Fig. 1706. Shrubby and branchy, somewhat hairy and glandular: lvs. with stalks 2–4 in. long, cordate-ovate in outline, with 2–3 pairs of oblong side lobes (lvs. pinnatifid), which extend nearly to the midrib and are again toothed and notched: stipules small, 2 pairs at each node: fls. few–several rather small, red or purplish, in umbels and with short pedicels.—A rather common greenhouse plant, the lvs. often with a dark spot.

14. **gravèolens,** Ait. Fig. 1707. Much like the last, but lvs. longer-petioled and palmately 5–7-lobed or parted, the broad lobes flat and pinnatifid into many mostly obtuse lobes: stipules cordate-acute: fls. many on mostly long peduncles, pink or light purple, small, the calyx hairy and nearly sessile, the calyx-lobes half as long as the petals.—This is one of the commonest forms of Rose Geranium. A typical leaf is well depicted in Fig. 1707 (lower figure).

15. **Rádula,** Ait. Fig. 1707. Differs from *P. graveolens* in the narrower divisions with revolute margins of the lvs.: the lvs. are deeply palmately parted, the lobes narrow-linear and pinnatifid, all rough-hispid on the upper surface and soft-pubescent beneath: fls. small, pale purple, with dark streaks.—Does not appear to be in the trade in a pure form, but the narrow-lvd. Rose Geraniums are probably hybrids between this and *P. graveolens*.

16. **denticulàtum,** Jacq. Fig. 1708. Much like *P. Radula*, but the leaf-lobes very denticulate and flat: lvs. glabrous and viscid above, plant weaker.—It has a balsamic odor. Perhaps it has entered into the garden forms of Rose Geranium.

1709. Pelargonium Limonium. (× ⅛.)

ccccc. *Lvs. small, round-cordate, 3-lobed half their depth and the margins toothed or jagged.*

17. **crispum,** Ait. Much branched and very scabrous or rough; lvs. 2-ranked, small and rigid, short-stalked, cuneate, truncate or slightly cordate at base, coarsely toothed: fls. 2–3 on short peduncles, violet, the lower petals narrow.—A neat, strict-growing plant with lemon-scented foliage. Probably not in general cultivation now in a pure form.

18. **Limònium,** Sweet. Lemon Geranium. Fig. 1709. Lvs. larger than in the last, not 2-ranked, soft: fls. purple and lilac.—A garden hybrid, *P. crispum* apparently being one of its parents. There is a form with variegated lvs. Sometimes known

to gardeners as *P. odoratum*. It is a neat and worthy plant, and showy when in flower. It has a lemon or palm scent. The variety known as Lady Mary is of this group.

B. *Stipules very minute and adnate.*

19. **exstipulàtum,** Ait. Resembles *P. crispum* in habit and foliage: lvs. round-ovate, small, velvety, about 3-lobed, the lobes cut-toothed or lobed: peduncles slender, with very small bracts: fls. small, white, with short spatulate petals.—Lvs. about ½ in. across, with odor of pennyroyal. Appears not to be in the trade, at least not in a pure form.

AAAA. *Plant with a short and thick more or less fleshy stem or caudex, from which arise slender branches, the lvs. long-stalked and reniform or cordate and obscurely lobed: stamens 6 or 7. (Cortusina.)*

20. **echinàtum,** Curt. The fleshy caudex armed with persistent spine-like stipules: lvs. white-tomentose, cordate-ovate and obtuse, about 3–5-shallow-lobed: calyx downy, the tube several times longer than the calyx-lobes: fls. white, with a spot near the center (varying to all purple), the petals notched. B. M. 309.—Now and then advertised. The fls. are said to change color during the day.

1710. Pelargonium odoratissimum. Natural size.

21. **odoratíssimum,** Ait. NUTMEG GERANIUM. Fig. 1710. Stem or caudex very short, throwing up many slender and weak soft-pubescent branches: lvs. very long-stalked, soft, round-cordate and very obtuse, obscurely 3- or more-lobed, the margins dentate-crenate: peduncles long and borne opposite the lvs., 5–10-fld.: fls. small, white, the petals about twice longer than the calyx-lobes.—A common plant, cult. for its pleasant-scented foliage. The plant known to gardeners as *P. fragrans* is either this species or a close derivative from it.

AAAAA. *Plant with short stem and tuberous roots, the lvs. pinnate or pinnately parted, the fls. in many-fld. umbels. (Polyactium.)*

22. **triste,** Ait. Stem or caudex very short, succulent: lvs. large, 2–3-pinnately compound pubescent, the ultimate teeth gland-tipped: calyx-tube long and stalk-like, much exceeding the pedicel, the lobes half as long as the petals: fls. brown-yellow with dark spots. B.M. 1641.—A well-marked species, occasionally offered in the trade.

23. **quinquevúlnerum,** Willd. Somewhat shrubby at base, sparingly branched, hirsute: lvs. 2-pinnatifid with linear toothed segments, the stipules broadly cordate and mucronate: fls. purple, scentless, the petals obovate, velvety and pale-edged; calyx-tube as long as the pedicels, somewhat hairy, the lobes obtuse.—Once offered by Saul.

24. **fúlgidum,** Willd. Stem shrubby, densely pubescent: lvs. pinnately 3-parted, silky on both sides, the central segments 3-lobed, all deeply toothed: peduncles usually branched, many-fld.: fls. small, bright scarlet, the petals obtuse; calyx-tube conspicuously swollen at the base and again just underneath the flower, thrice as long as the pedicel, the lobes linear-obtuse.—Not now seen in its pure form, but it is probably a remote parent in various small-flowered scarlet Geraniums.

L. H. B.

PELECÝPHORA (Greek, *hatchet-bearing;* from an alleged resemblance in the tubercles). *Cactàceæ.* HATCHET CACTUS. Stems globular, short-cylindric or clavate, small, often cespitose: tubercles strongly compressed from the sides; areolæ very long and narrow, bordered on each side by a row of about 20 very short, appressed comb-like spines: fr. naked. A genus of 2 species closely allied to Mammillaria.

asellifórmis, Ehrb. (from a fancied resemblance to Asellus, the wood-louse). Fig. 303, Vol. I. Juice watery: tubercles ashy green, more or less deeply grooved to the woolly axil; spines not projecting beyond the margin of areola: fls. purple with paler sepals: fr. near the center, red. Nuevo Leon and San Luis Potosi, Mex. I.H. 5:186.—Var. **cóncolor** has pure purple fls. B.M. 6061.

pectinàta, Schum. Juice milky: tubercles bright green with naked axils; spines projecting a little beyond the margin of tubercle: fls. yellow, lateral. Oaxaca, Mex. KATHARINE BRANDEGEE.

PELICAN FLOWER. *Aristolochia grandiflora.*

PELLǼA (Greek, *pellos,* dusky; from the usually dark-colored leaf-stalks). *Polypodiàceæ.* A genus of small, rock-loving ferns, with the sori at the ends of free veins forming a mostly continuous marginal band around the segments and covered by the more or less changed margin of the segments. Most species thrive best on limestone rocks.

A. *Lvs. simply pinnate.*

B. *Lfts. 4–5 pairs.*

Pringlei, Dav. Lvs. with 4–5 pairs of large triangular hastate stalked lfts. 1 in. or more either way: sorus forming a wide marginal band. Mexico.

BB. *Lfts. 5–8 pairs.*

Bridgesii, Hook. (*Platylòma Bridgesii,* J. Sm.). Lfts. subsessile, orbicular or subcordate, 4–5 lines long: sori confluent in a broad intramarginal band. Calif.

BBB. *Lfts. 20–40.*

rotundifòlia, Hook. Lfts. short-stalked, oblong or roundish, entire, obtuse. New Zealand.

falcàta, Fée (*Platylòma falcatum,* J. Sm.). Lfts. nearly sessile, lanceolate or lanceolate-oblong, mucronate and often slightly falcate, sori in broad lines. India to Australia and New Zealand.

AA. *Lvs. bipinnate.*

B. *Pinnæ formed of 3 sessile lfts.*

ternifòlia, Fée. Lvs. 6–12 in. long on strong dark chestnut stalks, narrow, with 6–12 opposite pairs of pinnæ; lfts. closely rolled together, linear. Trop. Amer.

BB. *Pinnæ (at least the lower ones) pinnate.*

Wrightiàna, Hook. Lvs. 3–6 in. long, 1–3 in. wide, deltoid; pinnæ with several linear-oblong pinnules on each side ¼ in. long, with inrolled edges and a sharp mucronate point. Texas to California.

atropurpùrea, Link. Lvs. 4–12 in. long, 2–6 in. wide, lanceolate to ovate-lanceolate, with several pinnules which are sessile, auricled or heart-shaped at the base, the broad line of sporangia nearly hiding the narrow marginal indusium. Eastern America to the Rocky mountains.

AAA. *Lvs. at least tripinnatifid.*

C. *Shape of lvs. triangular-deltoid, with narrow ultimate divisions.*

dénsa, Hook. CLIFF BRAKE. Lvs. 2–3 in. long, 1–1½ in. wide, on slender brown stalks; segments linear with enrolled edges sharp-pointed; indusium permanently covering the sori. Pacific North America.

cc. *Shape of lvs. elongate, ovate or lanceolate.*

andromedæfòlia, Fée. Lvs. 6–12 in. long, 3–6 in. wide; ultimate divisions 1½–2 lines long, linear-oblong, with enrolled edges. California.—Sometimes known as the Coffee Fern.

hastàta, Link. Lvs. 6–24 in. long, 6–12 in. wide; ultimate divisions ovate or lanceolate, 1–2 in. long, nearly sessile: sori in a narrow marginal line. Eastern and south Africa. Small lvs. are sometimes only bipinnate.

P. Stélleri, Beddome (P. gracilis, Hook.), a rare membranous species of the eastern states, is more closely allied to the genus Cryptogramma, to which Prantl has referred it.

L. M. Underwood.

PELLIÒNIA (J. Alphonse Pellion, officer in Freycinet's voyage round the world). *Urticàceæ.* Of this genus we cultivate 2 choice tender creeping foliage plants, suitable for baskets and for the borders of greenhouses under the benches. The genus contains about 20 species of herbs, often creepers, rarely subshrubs from tropical and eastern Asia and the Pacific islands. They have alternate, 2-ranked lvs. which are unequal at the base, entire or serrate: fls. monœcious or diœcious, in dense cymes; perianth segments 5, rarely 4, in fruit sometimes unchanged but usually increased and investing the fruit. The following are glabrous plants from Cochin China, with lvs. about an inch long and half as wide, and slightly crenate at the margin. All the species known to science are oriental. One of the species was once advertised as a Peperomia.

Daveauàna, N. E. Br. Lvs. dark bronzy olive-green more or less flushed violet or red, with a fern-like figure of light green down the middle of the leaf, the figure being narrowly oblong and crenate. This figure is sometimes absent from some of the lvs. The lvs. are more acuminate than in the next. R.H. 1880:290 (as *Begonia Daveauana*, a charming picture). I.H. 29:472 (poor).

púlchra, N. E. Br. Lvs. dull blackish along the midrib and veins, the inter-spaces being light green, the under surface pale purplish. I.H. 30:479. A.G. 15:4.

W. M.

PELLITORY. *Parietaria;* also an uncommon name of Feverfew, *Chrysanthemum Parthenium.*

PELORIA. See *Teratology.*

PELTÁNDRA (Greek, referring to the peltate anthers). *Aroideæ.* Arrow Arum. An east American genus with two species which have been much confused. They are stemless herbs, the glossy arrow-shaped leaves arising from strong underground parts: fls. monœcious and naked, the staminate ones on the upper part of the long spadix, the anthers sessile and imbedded and opening by terminal pores, the 1-loculed ovaries attended by 4 or 5 scale-like bodies or staminodia: spathe usually exceeding the spadix: fr. a 1–3-seeded, mostly leathery berry, borne in large globose clusters. Peltandras are excellent subaquatic plants, their large thick sagittate leaves always adding variety and interest to margins of ponds and to bog gardens. Single specimens or clumps are usually most prized. Peltandras are easy to colonize.

undulàta, Raf. Lvs. narrow-sagittate, the basal lobes long and nearly or quite acute: spathe 4–8 in. long, green, convolute around the spadix for its whole length: sterile part of the spadix much longer than the pistillate part: fr. green, 1–3-seeded. In shallow pools or bog margins, N. Eng. to Fla. and W. A.G. 1893:111.—The root is composed of thick cords or fibers.

álba, Raf. Lvs. broader, the basal lobes short: spathe white, the upper part expanded and calla-like: sterile part of spadix little, if any, longer than pistillate part: fr. red, 1-seeded. Va., S.—Root tuberous. L. H. B.

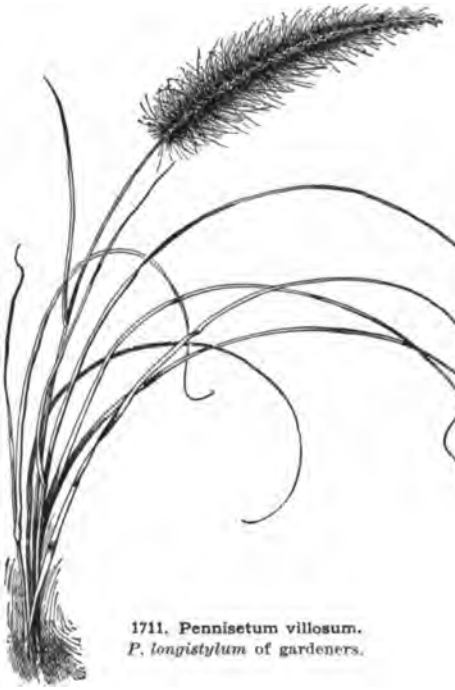
PELTÓPHORUM (Greek, *shield-shaped;* referring to the peculiar stigma). *Leguminòsæ.* Six species of splendid tropical trees, belonging to the same tribe with the gorgeous Poinciana and Cæsalpinia, all of which represent a type of structure widely different from our northern pea-shaped flowers, as they have 5 distinct petals which are all about the same size and shape. There is a fine colored plate of a Peltophorum in Blanco's "Flora of the Philippines," where the golden yellow fls. are nearly 1½ in. across, a dozen of them in each raceme, and 4 racemes uniting to form a great panicle. The Philippine species, *P. inerme*, is probably the same as the Australian one, *P. ferrugineum*, which Franceschi has introduced at Santa Barbara, Calif., but reports so far unsuccessful. Peltophorums have the Mimosa type of foliage. Each leaf of *P. ferrugineum* has 8–10 pairs of pinnæ, and each pinna 10–20 pairs of leaflets.

Generic characters: petals 5, roundish; stamens 10, free, declinate; filaments pilose at base: ovary sessile, 2 to many-ovuled: pod flattish, indehiscent, with narrowly winged margins.

Peltophorum is distinguished from Cæsalpinia and Poinciana by the valvate calyx segments of the latter, while the two former have their calyx segments strongly imbricated. The peculiar stigma of Peltophorum readily distinguishes it from its close allies, Cæsalpinia and Hæmatoxylon (log-wood).

ferrugíneum, Benth. (*P. inérme*, Naves). Tree attaining 100 ft., taking its specific name from the dense rusty tomentum which covers the young branches, petioles and inflorescence: pod 3–4 x ¾–1 in. wide, bearing 1–3 seeds. Australia, Philippines. W. M.

PENNISÈTUM (*penna*, a feather; *seta*, a bristle). *Gramíneæ.* Contains about 40 species of the tropical regions. One species, Pearl Millet, is cultivated for fodder. The genus is allied to Panicum and Setaria, the spikelets being 1-fld., with usually 4 glumes, surrounded at base by a cluster of bristles and arranged in spikes or spike-like racemes. First glume very small, second longer than fl.-glume. The bristles fall with spikelets instead of remaining attached to rachis as in Setaria.



1711. Pennisetum villosum.
P. longistylum of gardeners.

villòsum, Brown (*P. longistylum* of florists, not of Hochst.). Fig. 1711. Spike broad, 2–4 in. long, and feathery from the bearded bristles: culm 1–2 ft. high, pubescent below the spike. Abyssinia. R.H. 1890, p. 489.

Rüppellii, Steud. (*P. Rupeliànum* of some works). Culms taller and spikes longer and more graceful than the preceding. Abyssinia. R.H. 1897, pp. 54, 55. I.H. 42, p. 206 (1895).

typhoideum, Rich. (*Penicillària spicàta*, Willd.). PEARL MILLET. Culm 3–8 ft., bearing a close cylindrical spike 3–10 in. long, ¾ in. thick, pubescent below the spike: lvs. long and broad. Native country unknown. Occasionally grown in the southern states, where it ripens seed. May be grown farther north for forage.—A luxuriant annual long cult. in the Old World for forage and more or less for the fruit, which is used as food.

Japónicum, Trin. (*P. compréssum*, R.Br. *Gymnòthrix Japónica*, Kunth.). A low annual with long narrow lvs. cult. for ornament. Culm 2–3 ft., scabrous, especially under the dense cylindrical spike; bristles unequal, naked. Australia.

macroùrum, Trin. (*Gymnòthrix caudàta*, Schrad.). A tall perennial with stout culm bearing a dense pointed spike about a foot long. Bristles naked. South Africa. —Cult. for ornament.

latifòlium, Spreng. (*Gymnòthrix latifòlia*, Schult.). An ornamental perennial. Culm 3–4 ft., bearing several nodding spikes 1–2 in. long: lvs. lanceolate, ½ in. broad: bristles short, naked. Argentine Republic. R.H. 1890, p. 546.

A. S. HITCHCOCK.

The fine plumy grass known to gardeners as *Pennisetum longistylum* is much used for bedding. It is, perhaps, the finest dwarf grass which is grown chiefly for its flowers. It sometimes survives the winter at Washington, D.C., but should always be treated as a tender subject. Plants raised every year from seed are satisfactory if seed is sown early enough, but divisions of old plants will give larger pieces which flower sooner and require less attention than seedlings. The old plants may be wintered anywhere out of reach of frost. About February 1, in the latitude of Washington (a month later North), cut off the old leaves to within 6 in. of the crowns: divide the clumps into small pieces, trim the roots so that they will ultimately go into 3- or 4-in. pots, and place the pieces thickly together in boxes of sandy soil in a greenhouse with a temperature of about 60°. As soon as new roots have started pot the young plants. They may be removed to a coldframe long before the soft bedding material demands all the available indoor space.

G. W. OLIVER.

PENNSYLVANIA, HORTICULTURE IN. Fig. 1712. During the past century Pennsylvania has been prominently before the world because of its mineral wealth. The ruins of many iron works located in rural districts are now reduced to the primitive stone masonry of the smelting furnace, but mark the places of great activity previous to 1850. Later, these industries were concentrated in towns and cities, where, with improved appliances, new methods of transportation and greater facilities for handling labor and capital greatly lessened cost of production and increased the capacity of furnaces. Now, at the close of the nineteenth century, a vast majority of the once profitable iron-ore beds is exhausted or forsaken because of richer fields discovered in other states. Coal, both bituminous and anthracite, is still most actively mined, and extensive areas are sacrificed by farmers to the coal digger in the western counties and in the anthracite region in the northeast. The same may be said of the northwestern section, yielding petroleum and gas.

The forest operations in Pennsylvania have long ago passed the high-water mark of their activity. The white pine forests of the Alleghany mountains, the stretch of hemlock spruce which covered the belt of counties touching the western slope of the Alleghany mountains, and the groves of cherry and black walnut are fast disappearing. Formerly Pennsylvania stood first among the states in the output of forest products. Originally the state was essentially covered with forest, but now Dr. J. T. Rothrock, Forestry Commissioner of Pennsylvania (Report of 1895), declares that less than 36 per cent of the area of the state is in timber.

Pennsylvania has an area of 45,215 square miles, nearly rectangular in outline—157.76 miles broad between the northern and southern boundaries by an average length of 285.85 miles running due east and west. This area is crossed slantwise by the broad band of Appalachian mountains, making three distinct topographical regions.

The eastern region comprises all that territory lying southeast of the Kittatinny mountains, or a line drawn from Franklin to Northampton counties. It is gently undulating, rising in places to great hills which assume the proportions of a mountain in the South mountain range. This region was first settled and is now mostly cleared and cultivated. The richest lands of the state are found in this section.

The central or mountain region is a belt about 50 miles broad, made up of parallel mountains and narrow valleys comprising one-fourth the area of the state. The western boundary of this region is the Alleghany mountains, the greatest of them all. The valleys are covered for the most part with excellent grain land, but the hills and mountain slopes are stony and more or less barren.

The western and largest region has an area of 24,861 square miles, or about 55 per cent of the entire state. It is essentially a high plain, marked in the north, where the elevation is greatest, by deep-seated streams or cañons, some of them 500–800 feet deep. The elevation gradually decreases toward the southwest. There is much land so recently cleared that no attempt has yet been made to utilize it for agricultural or horticultural purposes. There is no question, however, but that much of it could be easily put into condition for fruit culture.

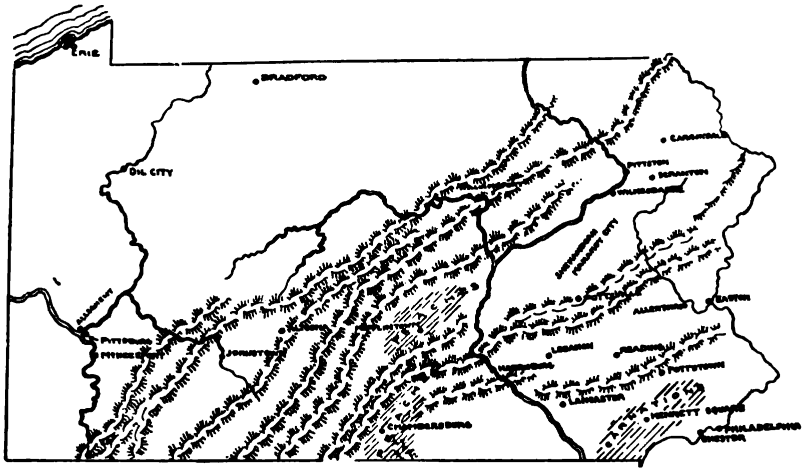
The statistics of 1890 show that Pennsylvania has 18 seed farms, covering an area of 6,066 acres. The seeds extensively produced here are beans, cabbage, carrot, field corn, cucumber, lettuce, parsnip, onion sets and potatoes. Several of the largest seed houses of the United States are located in Philadelphia, that of David Landreth having been established in 1784. There were reported for 1890 311 nurseries, with a total area of 6,598 acres, representing a value of more than $3,000,000. The stock chiefly grown is made up of apples, cherries, peaches, pears, plums, deciduous and evergreen trees and shrubs. In the cultivation of ornamental plants and the production of cut-flowers Pennsylvania takes a prominent place. The census of 1890 was the first to take notice of this industry and shows 544 establishments, with a total of 6,066,144 square feet of glass, being second only to New York. The size of these establishments ranges from 300 to 100,000 square feet of glass. The largest number of roses was propagated in Pennsylvania in the year these statistics were gathered. The largest total values of plant sales were respectively in New York, Pennsylvania and California; and the largest total values of cut-flower sales were respectively in New York, Illinois and Pennsylvania. In truck farms Pennsylvania joins with New Jersey and New York in forming the most important district of America. This district excels all others in the production of beets, cabbage and tomatoes, and has large acreages in asparagus, beans, celery, cucumbers, melons, peas, Irish and sweet potatoes.

The fruit interests of the state are not as great as they should be. Apples are grown successfully in the larger part of the territory, but mainly for home or local consumption. A few orchards of commercial extent have been planted in the last quarter century. The best varieties for market are York Imperial, Smith Cider, Fallawater (all of Pennsylvania origin), Baldwin, R. I. Greening and Ben Davis. Peaches are now grown extensively in two sections in and about Franklin and Juniata counties, known respectively as the "South Mountain" and the "Juniata" peach belts: each belt reports an area of 3,000 acres devoted to peaches. W. G. Waring has observed that "peach trees in Pennsylvania grow to a much larger size and greater age than along the Atlantic shore." Plums and cherries are not extensively grown. Grapes are adapted to this state, but nowhere except in Erie county has the extension of vineyards been rapid, and there it was due to the influence of the Chautauqua grape belt of New York, of which the Erie county vineyards form a part. More attention was given to pears 40 years ago than now on account of the present fear of the "fire blight." Pennsylvania has contributed some of the most valuable varieties of pears now in cultivation, such as the Seckel, Tyson, Brandywine, Ott, Jones and Kingsessing; also the Kieffer, now a leading commercial variety.

In floriculture a portion of Chester county has become noted as the "carnation belt" because of the numerous establishments there making specialties of producing the cut-flowers and breeding improved varieties.

The Bartram Garden was the first attempt in the United States to gather plants and trees for the purpose of study. See p. 758. It was established in 1728 by John Bartram along the Schuylkill river. It is now in that part of Philadelphia known as Kingsessing. Through the untiring and zealous efforts of that broad-minded horticulturist, Thomas Meehan, the city of Philadelphia in 1891 purchased 12 acres of land from the Eastwick estate, which contained the original garden, and thus the preservation of this old horticultural monument seems to be assured. It is now only one of many small parks possessed and cared for by the city of Philadelphia. The principal parks of the state are Fairmount Park in Philadelphia, in which definite work was begun about 1860; the buildings of the Centennial Exposition were placed on these grounds in 1876. It has an area of 2,200 acres and is well maintained. Allegheny parks occupy the ground formerly known as the Commons in Allegheny City. Of more recent establishment are Schenly and Highland Parks, in Pittsburg. The cemeteries of the larger cities are in the hands of competent superintendents, and the park ideas of landscape and ornamentation are becoming the prominent features of these sacred grounds.

Geo. C. Butz.



1712. Pennsylvania, to illustrate some of the horticultural regions.

PENNYROYAL of Europe, *Mentha Pulegium;* of America, *Hedeoma pulegioides.* **Bastard P.**, or Blue Curls, is *Trichostema dichotomum.* All are members of the Mint family.

The garden Pennyroyal, *Mentha Pulegium*, is a European perennial, used for seasoning. It is one of the "sweet herbs." It is easily grown, profiting by a winter protection of leaves or litter. Prop. by seeds or division. Beds should be renewed frequently.

PENTACHÆTA (Greek, referring to five bristles at the base of the pappus). *Compósitæ.* Six species of low, slender, Californian annuals with thread-like, alternate lvs. and small or medium-sized heads, the rays when present usually yellow, sometimes white: the disk-fls. sometimes turning purple. *P. aùrea*, Nutt., growing 3–12 in. high and with 7–40 deep golden rays, was offered by Orcutt in 1891 and was pictured in Gt. 1153, but has no horticultural standing.

PENTÁPETES (Greek, *having 5 leaves;* an ancient name of some cinquefoil, transferred by Linnæus to this plant, which has 5 leafy growths (staminodes) accompanying the stamens). *Sterculiàceæ.* A pretty red-fld. tender annual, widely distributed in tropical Asia and beautifully figured in Blanco's "Flora of the Philippines," but rare in European gardens and unknown in America. It is a branched plant growing 2–5 ft. high, with fls. which open at noon and close at the following dawn. The fls. are nearly 1½ in. across, 5-petaled, axillary, short-peduncled. Recommended to lovers of rare, tender annuals.

A genus of one species. Bractlets 3, caducous: sepals 5, lanceolate, connate at the base; petals 5; stamens 20, connate at the base, 15 fertile in 5 groups of 3 each, alternating with 5 staminodes which are nearly as long as the petals: ovary 5-celled; cells many-ovuled: capsule loculicidally 5-valved: seeds 8–12, in 2 series in each cell.

phœnicea, Linn. Lvs. 3–5 in. long, 1-nerved, crenate-serrate; petiole 1 in. long; stipules awl-shaped. B. R. 7:575.

PÉNTAS (Greek, *five;* referring to the floral parts; which, however, is not strictly true of the genus nor a rarity in the family). *Rubiàceæ.* Nine species of tender herbs and subshrubs, resembling Bouvardias of the same family, but not their closest ally. They are all natives of tropical Africa, except one which comes from Madagascar. The favorite species is *P. carnea*, whose color varieties range through lilac and flesh color to crimson-pink and rosy purple. A good cluster is 3 in. across and contains 20 or more fls., each of which is ½ in. across. The fls. are about ¾ in. long, funnel-shaped, and generally have 5 spreading lobes, sometimes 4 or 6. It is usually grown like Bouvardia in warm conservatories for winter bloom, but it is sometimes used for bedding in warmer countries, as it gives three months of rather showy bloom when treated like Lantana. In general, the species seem to be less worthy than Bouvardias.

Generic characters: Herbs or subshrubs, erect or prostrate, hispid or tomentose: lvs. opposite, stalked, ovate or ovate-lanceolate; stipules multifid or multisetose: inflorescence usually corymbose: calyx-lobes 4–6, inequal; corolla pilose, the long tube dilated and villous in the throat; lobes valvate; stamens 4–6, inserted below the throat; filaments short or long; anthers fixed at the back, included or exserted: disk tumid or annular, often produced into a cone after anthesis: ovary 2-loculed: ovules numerous: style-branches papillose: capsule membranous or leathery, 2-loculed, loculicidal; seeds minute. Six species are given in the Flora of Tropical Africa 3:45 (1877).

A. *Fls. not white.*

cárnea, Benth. Erect or decumbent, 1–2 ft. high, shrubby at base, merely puberulous, not at all rusty-hairy: lvs. 1–6 in. long, 4½ lines to 2 in. broad, ovate, elliptic or lance-oblong: cymes peduncled or not. B.M. 4086. B.R. 30:32. R.B. 21:217. Gn. 21, p. 329. J.H. III. 30:209. R.H. 1870:130 (var. *kermesina*). Var. **Quartiniàna** (*P. Quartiniàna*, Oliv.) is a rosy-fld. var. said to be much better than the type. Gt. 45, p. 464.

AA. *Fls. white.*

lanceolàta, Hort. This novelty of 1900 is figured in Dreer's catalogue, which says, "A pretty half-shrubby greenhouse plant, not unlike a Bouvardia in general appearance, but flowering more profusely and continuously. It may be planted in the open border during the summer, but it is valuable chiefly as a winter-flowering pot-plant, for which purpose it is especially well suited, being in flower all the time. The pure white flowers are produced in flat heads of 15 to 30 flowers each, similar to a Bouvardia, but much larger, and last in perfection a long time."

W. M.

PENTLÁNDIA. See *Urceolina.*

PENTSTÈMON (Greek for *five stamens*, all 5 stamens being present, whereas related genera have only 4; but in Pentstemon one of the stamens is commonly sterile). *Scrophulariàceæ.* PENTSTEMON. BEARD-TONGUE. For the hardy border, Pentstemons are most satisfactory plants, and the great number of showy species allows much latitude in choice of color and habit. All are perennial, but some of them bloom the first year from seed. In a dry and hot place they are likely to be short-lived, although nearly all the species thrive best in full exposure to sun. They are not particular as to soil. They are propagated by division and by seed. Many of the species are not hardy in the northern states, but *P. barbatus* and its varieties, *P. pubescens*, *P. lævigatus* and variety, *P. confertus* and variety, *P. diffusus*, *P. ovatus*, *P. grandiflorus*, *P. acuminatus*, *P. cæruleus*, *P. glaber* and varieties, and also others. may be expected to stand in the North, particularly if given a protection of leaves. An excellent garden race has been produced, here designated as *P. gloxinioides.* This seems to be a product of hybridization and selection. It is little known in American gardens, although it is a handsome and deserving plant. Some of the forms of it are treated as annuals.

Pentstemon is a typical American genus. One species is native to northeastern Asia and several to the cooler parts of Mexico, but the larger number of the 100 species inhabit the United States and Canada, particularly the western parts. They are all herbs, although some species are somewhat woody at the base. They bear long-tubular often 2-lipped flowers in terminal usually interrupted or leafy clusters. The anther-bearing stamens are 4, the cells of which are united or confluent at the apex but separate at the base; the fifth stamen is represented by a prominent sterile filament (which rarely bears an anther). The style is filiform and the stigma entire; the fruit is a globular-pointed capsule, containing wingless seeds.

It is difficult to so arrange the species of Pentstemon as to make them easy of determination by the horticulturist. There is no monograph of all the species, but Gray's account in the Synoptical Flora (Vol. 2, Part 1) describes the American species north of Mexico; and this account has been closely followed here. The arrangement of species, however, has been modified considerably to admit the Mexican species and to make the group easier for the beginner. The following account contains all the Pentstemons, with one exception, known to be in the Amer. trade. This exception is "*P. rubicaulis*; 1 ft., rich crimson, from Oregon," which is in the trade but unknown to the writer. Other species are mentioned in Old World literature. Other native species will appear in the Amer. trade: these may be found in Gray.

INDEX.

acuminatus, 14.
angustifolius, 19.
antirrhinoides, 3.
atropurpureus, 19.
azureus, 38.
barbatus, 5.
cæruleo-purpureus, 17.
cæruleus, 15.
campanulatus, 19.
centranthifolius, 8.
Clevelandi, 25.
Cobæa, 28.
coccineus, 5.
confertus, 17.
cordifolius, 2.
crassifolius, 1.
cristatus, 29.
cyananthus, 9.
cyanthus, 9.
deustus, 26.
diffusus, 34.
Digitalis, 23.
Douglasii, 1.
gentianoides, 6.
glaber, 9.
glandulosus, 32.
gloxinioides, 7.
Gordoni, 9.
gracilentus, 36.
gracilis, 21.
grandiflorus, 12.
Hartwegi, 6.
heterophyllus, 39.
humilis, 20.
Jaffrayanus, 38.
lætus, 37.
lævigatus, 23.
Lemmoni, 4.
Lobbii, 3.
Menziesii, 1.
Murrayanus, 13.
Newberryi, 1.
ovatus, 30.
Palmeri, 24.
procerus, 17.
pubescens, 31.
pulchellus, 19.
puniceus, 10.
Richardsoni, 35.
Robinsoni, 1.
roseus, 19.
rotundifolius, 18.
Scouleri, 1.
secundiflorus, 16.
speciosus, 9.
spectabilis, 27.
staticifolius, 32.
Torreyi, 5.
tubiflorus, 22.
venustus, 33.
Wrightii, 11.

A. *Cells of anthers dehiscent for nearly or quite their whole length, united or connivent at the apex and soon spreading from each other.* (AA. No. 32.)

B. *Anthers covered with long wool.*

1. **Ménziesii**, Hook. Woody at base, 1 ft. or less high: lvs. thick, obovate to oblong, serrate or entire, mostly glabrous, the lower ones short-stalked: cluster a raceme, pubescent: fls. 1 in. or more long, violet-blue to purple, usually 1 on each pedicel, the upper lip 2-cleft and the lower 2-cleft. Wyo., west and northwest.

Var. **Néwberryi**, Gray (var. *Róbinsoni*, Mast.). Fls. pink or rose-purple. Calif. G.C. 1872:969.

Var. **Doùglasii**, Gray (*P. Doùglasii*, Hook. *P. crassifòlius*, Lindl.). Fls. lilac-purple, pink at base: lvs. oblong or obovate-lanceolate, entire. Ore., north. B.R. 24:16.

Var. **Scoùleri**, Gray (*P. Scoùleri*, Lindl.). Fls. violet-purple: lvs. lanceolate to linear-lanceolate, sparsely serrulate. Ore., north. B.R. 15:1277. B.M. 6834. G.C. III. 7, p. 204. Gn. 52, p. 42.

BB. *Anthers glabrous or only hairy (not woolly).*

C. *Plant semi-scandent (somewhat climbing) by means of long, slender branches.*

2. **cordifòlius**, Benth. Plant very leafy, somewhat pubescent: lvs. ovate, serrate, 1 in. or less long: cluster or thyrse short and leafy, the peduncles several-fld.: corolla tubular, scarlet, the tube 1 in. long and the limb half as long. S. Calif. R.H. 1850:221.

CC. *Plant erect, self-supporting.*

D. *Corolla lemon-yellow to yellow-red.*

3. **antirrhinoides**, Benth. (*P. Lóbbii*, Hort.). Plant 1–5 ft., glabrous or nearly so, branched and leafy: lvs. small, oval or spatulate, entire: fls. in leafy panicles, the peduncles 1-fld., the broad fls. about 1 in. long, the lower lip deeply 2-lobed; sterile filament bearded on one side. S. Calif. B.M. 6157. I.H. 9:315.

4. **Lémmoni**, Gray. Slender shrub, 5 ft. or less tall, bright green and glabrous: lvs. ovate-lanceolate, toothed: panicle loose and branchy, the long peduncles 2–7-fld.: fls. small, dull yellowish and red, the segments nearly equal. Central Calif.

DD. *Corolla not yellow (unless occasionally in P. confertus), mostly in shades of red or purple, sometimes white.*

E. *Stem and lvs. glabrous, at least up to the inflorescence.* (EE. No. 28.)

F. *Corolla long and slender, not swollen near the base or greatly widened at the mouth: straight-flowered species.*

5. **barbàtus**, Nutt. Tall, erect, branching, glabrous and more or less glaucous herbs: lvs. firm, varying from lanceolate to linear, entire, strong-veined, the radical ones oblanceolate or spatulate: fl.-cluster long and open, narrow, the peduncles about 2–3-fld.: fls. slender, about 1 in. long in wild forms, strongly 2-lipped, varying from light pink and flesh color to carmine, the lower lip usually bearded. Colo., south. B.R. 25:21. R.H. 1896, p. 347. Mn. 7:141.—A showy perennial, and common in cult. One of the best.

Var. **Tórreyi**, Gray (*P. Tórreyi*, Benth.), is a scarlet-fld. form, with almost no beard on the lower lip; the commonest form of the species in cult. Excellent.

Var. **coccíneus**, Hort., is a scarlet-fld. horticultural form.

6. **Hártwegi**, Benth. (*P. gentianoìdes*, Lindl.). Tall and erect (3–4 ft. high), somewhat branched, the stems dark purple: lvs. lanceolate to lance-oblong-linear, or the upper ones broader, sessile, glabrous and entire: fl.-cluster somewhat pubescent, long and open, the pedicels 3–6-fld.: fls. drooping, dark rich purplish red, slightly curved, the limb somewhat 2-lipped and the lobes acute. Cool regions in Mexico. B.M. 3661. B.R. 24:3. Gn. 37, p. 603; 49, p. 406.—A fine garden plant, now much modified by domestication.

7. **gloxinioides**, Hort. A race of garden hybrids, issuing largely from *P. Hartwegi;* the other most important parent being *P. Cobæa.* Probably other species have entered into the amalgamation. The group needs critical study from the growing plants. The fls. are large, with a broad nearly regular limb, and in many colors. The plants are strong and floriferous. Flowers sometimes measure 2 in. across. Some of the strains bloom freely from seed the first year. Not hardy in New York, unless very thoroughly protected ; it is probably better to winter it in deep coldframe.

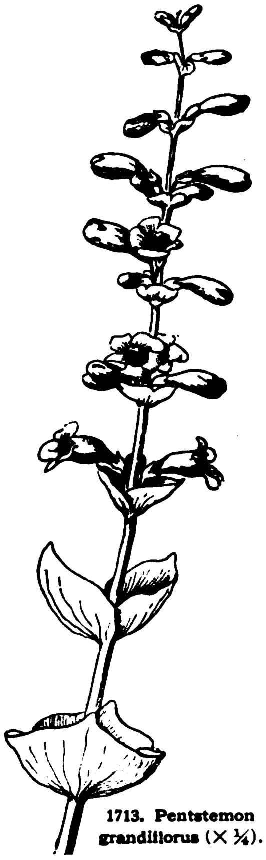
8. **centranthifòlius**, Benth. Plant strict and leafy, 1–3 ft. tall, very glaucous: lvs. thick and entire, from ovate-lanceolate to linear, mostly sessile and clasping: inflorescence long and narrow, the peduncles 2–3-fld.: fls. about 1 in. long, scarlet, narrow-tubular, the lobes short and acute; sterile filament naked. Calif. to W. Ariz. B.M. 5142. F.S. 22:2309.

FF. *Corolla (except in P. rotundifolius) with a prominently enlarging tube, which is often contracted near the base: thick-flowered species. Corolla nearly straight, but short in P. confertus.*

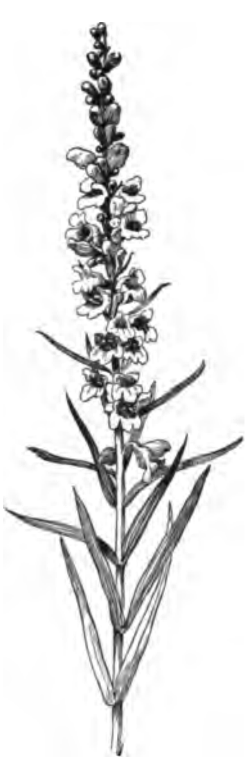
G. *Leaves entire (sometimes serrulate in P. confertus).*

H. *Dehiscence of anther cells extending from base but not through the apex.*

9. **glàber**, Pursh (*P. Górdoni*, Hook. *P. speciòsus*, Dougl.). Erect herb (1–2 ft.), with simple stems, glabrous and somewhat glaucous: lvs. oblong-lanceolate to ovate-lanceolate: fl. 1 in. or more long, broad and wide at the mouth, bright blue to purplish. Mo. river west. B.M. 1672 (as *P. glabra*) and 4319. B.R. 15:1270. Gn. 27, p. 42. R.H. 1895, p. 383; 1896, p. 347.—A very handsome plant, known by its large blue fls.



1713. Pentstemon grandiflorus (× ¼).



1714. Pentstemon cæruleus (× ¼). A slender form.

Var. **cyanánthus**, Gray (*P. cyánthus*, Hort.). Tall and less glaucous, the lvs. broader (ovate or cordate-ovate to lance-ovate): fl.-cluster dense: fls. bright blue. Rocky Mts. R.H. 1851:453.—Preferable to the type.

HH. *Dehiscence of anther cells extending from the base to the very apex and through the junction or confluence of the two cells at the apex.*

I. *Inflorescence rather close and compact.*

J. *Shape of some or all of the leaves as broad as ovate or obovate.*

10. **puniceus**, Gray. Very glaucous, with short ovate sometimes connate lvs.: fl. about 1 in. long, more funnelform (or widening upwards) and with wide-spreading rounded lobes, scarlet; sterile filament bearded down one side. Ariz. R.H. 1892, p. 448.

11. **Wrightii**, Hook. Rather stout, 2 ft. or less tall, more or less glaucous: lowest lvs. obovate, the upper ones oblong and clasping: inflorescence long and loosely fld., to peduncles about 2-fld.: fls. about ¾ in. long, bright red, the mouth broad and the rounded lobes spreading ¾ in. W. Tex. and N. Mex. B.M. 4601. F.S. 7:685.

12. **grandiflòrus**, Nutt. Fig. 1713. Stout, very glaucous: lvs. thick, broad and obtuse, the floral ones with very broad bases: peduncles very short or almost none: fls. nearly or quite 2 in. long, lilac or blue, enlarging near the base, somewhat 2-lipped and the upper lip the smaller; sterile filament minutely pubescent at the tip: fr. large. Wisconsin, south and west.—Handsome.

13. **Murrayànus**, Hook. Erect, 3 ft.: lvs. broad-ovate, clasping, and the upper pairs grown together into a cup-shaped body (connate): pedicels 2–3 in. long: fls. deep scarlet, with rather small lobes; sterile filament glabrous. Tex. B.M. 3472. Gn. 26, p. 229. R.H. 1896, p. 348.

14. **acuminàtus**, Dougl. Glaucous, strict and usually stiffish, 2 ft. or less tall: lvs. thickish, the lowermost broadly ovate to obovate, the uppermost lance-ovate to short-ovate and clasping and usually acuminate, the floral lvs. shorter than the fls.: inflorescence narrow, the peduncles 1–3- or more fld.: fls. nearly 1 in. long, lilac to violet, wide at the throat, the obtuse lobes spreading; sterile filament bearded at the tip. Mo. river, west and south. B.R. 15:1285.—Very satisfactory.

JJ. *Shape of leaves lanceolate to linear.*

15. **cærùleus**, Nutt. Fig. 1714. Mostly lower: lvs. linear to lanceolate, those at the base of the fl.-cluster usually exceeding the fls.: inflorescence usually close: fls. blue, varying to lilac or white. Dakota to Colo.—Seems to run into *P. acuminatus.*

16. **secundiflòrus**, Benth. About 2 ft. tall: lvs. narrow-lanceolate, somewhat glaucous, the radical ones spatulate: inflorescence long and strict, the peduncles 1–3-fld.: fls. lilac or purple, the basal tube about twice the length of the calyx, the throat broad and bell-shaped and about equaled by the spreading rounded lobes; sterile filament glabrous or bearded only at the top. Colo.—Handsome.

17. **confértus**, Dougl. One to 2 ft., pubescent in the inflorescence: lvs. oblong to lanceolate to linear, usually entire but sometimes minutely serrate: inflorescence a narrow interrupted spike, the peduncles sessile or the lower ones stalked: fls. ½ in. or less long, cream-white to sulfur-yellow, narrow, 2-lipped, the lower lip bearded within. Rocky Mts. to Ore. B.R. 15:1260.

Var. **cærùleo-purpùreus**, Gray (*P. pròcerus*, Dougl.). Fls. blue-purple to violet. Colo., west and north. B.M. 2954. L.B.C. 17:1616.—A common form in gardens, and a reliable and satisfactory plant.

II. *Inflorescence very open and loose, due to the fact that the peduncles are 3–6 in. long and the pedicels 1 in. or more long and the fls. drooping.*

18. **rotundifòlius**, Gray. About 2 ft. tall, branching from the base, glaucous: lower lvs. thick and leathery, orbicular-ovate and obtuse, long-petioled, stem-lvs. sessile and cordate-orbicular: fls. 1–1½ in. long, narrow-tubular, yellow-red, the lobes short and acute; sterile filament glabrous. Northern Mex. B.M. 7055. G.C. III. 4:265. G.F. 1:473.

GG. *Leaves serrate or dentate.*

H. *Sterile filament bearded at the tip or along one side.* (HH. No. 26.)

I. *Color of fls. purple, blue or rose, incidentally ranging to white.*

19. **campanulàtus**, Willd. Branching from the base, 2 ft. or less tall: lvs. lanceolate or the upper ones ovate-lanceolate, long-acuminate, broad at the base and sessile, strongly serrate: inflorescence long and narrow, the peduncles usually 2-fld.: fls. 1 in. long, rose-purple, the narrow base of the tube about the length of the

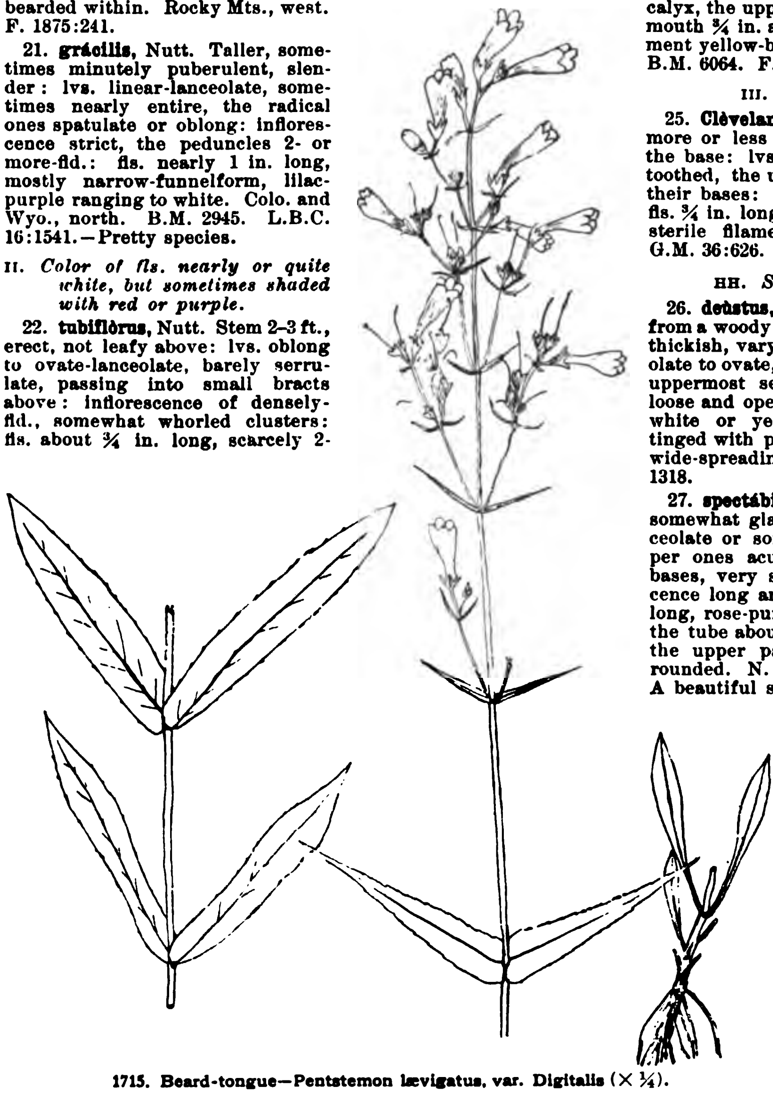
calyx, the upper part broad and ventricose, the subequal lobes rounded and spreading, the throat hairy; sterile filament hairy at the top. Mex. B.M. 3884.—An old garden plant which is variable in color and which has received many names, as *P. angustifolius, atropurpureus, pulchellus, roseus.* See B.R. 13:1122 and 14:1138. L.B.C. 15:1429, 1438.

20. **hùmilis,** Nutt. Low, usually not over 6 in. tall, pubescent in the inflorescence: lvs. oblong to lanceolate, somewhat glaucous, the upper ones small-toothed: inflorescence 3–4 in. long, with 2–5-fld. peduncles: fls. ⅝ in. long, rather narrow, deep blue or sometimes ranging to white, the lower lip bearded within. Rocky Mts., west. F. 1875:241.

21. **grácilis,** Nutt. Taller, sometimes minutely puberulent, slender: lvs. linear-lanceolate, sometimes nearly entire, the radical ones spatulate or oblong: inflorescence strict, the peduncles 2- or more-fld.: fls. nearly 1 in. long, mostly narrow-funnelform, lilac-purple ranging to white. Colo. and Wyo., north. B.M. 2945. L.B.C. 16:1541.—Pretty species.

II. *Color of fls. nearly or quite white, but sometimes shaded with red or purple.*

22. **tubiflòrus,** Nutt. Stem 2–3 ft., erect, not leafy above: lvs. oblong to ovate-lanceolate, barely serrulate, passing into small bracts above: inflorescence of densely-fld., somewhat whorled clusters: fls. about ¾ in. long, scarcely 2-lipped, the spreading limb nearly as long as the tube, white or nearly so and sometimes tinged with purple. Kans. and Ark.



1715. Beard-tongue—Pentstemon lævigatus, var. Digitalis (× ¼).

23. **lævigàtus,** Solander. Tall and slender, 2–4 ft., more or less glaucous: lvs. rather firm, purplish, somewhat glossy, ovate to ovate-oblong-lanceolate and clasping, the radical ones oblanceolate or broader, all small-toothed: inflorescence long and loose: fls. about 1 in. long, white and sometimes tinged with color, rather slender, narrow at the base, the short lobes not wide-spreading, the small lower lip bearded at the base. Pa., west and south. B.M. 1425.—A common plant, best known in the form

Var. **Digitàlis,** Gray (*P. Digitàlis,* Nutt.). Fig. 1715. Very tall, 4–5 ft., with larger white abruptly inflated flowers. B.M. 2587.—Sometimes becomes a weed in old fields. It is in cultivation as a border plant.

24. **Pálmeri,** Gray. Plant 2–3 ft. tall, the foliage glaucous: lvs. thick, ovate to oblong-lanceolate, the lower petioled and the upper connate, very sharp-dentate or sometimes almost entire: inflorescence long, mostly glandular: fls. cream-white tinted with pink, the narrow part of the tube about as long as the calyx, the upper part very wide and open, the mouth ¾ in. across and 2-lipped; sterile filament yellow-bearded. Utah, south and west. B.M. 6064. F.S. 20:2094. F. 1874:37.

III. *Color of flowers red.*

25. **Clèvelandi,** Gray. Two ft. or more, more or less glaucous, becoming woody at the base: lvs. rigid, oblong or ovate, sharp-toothed, the upper ones usually connate by their bases: inflorescence long and narrow: fls. ¾ in. long, crimson, with narrow throat; sterile filament bearded at top. S. Calif. G.M. 36:626. F. 1878, p. 149.

HH. *Sterile filament glabrous.*

26. **deùstus,** Dougl. Stems 1 ft. or less tall from a woody base, glabrous throughout: lvs. thickish, varying from nearly linear to lanceolate to ovate, some or all of them serrate, the uppermost sessile: inflorescence many-fld., loose and open: fls. not over ⅝ in. long, dull white or yellowish white and sometimes tinged with purple, wide-mouthed, the lobes wide-spreading. Montana to Calif. B.R. 16:1318.

27. **spectábilis,** Thurber. Two–4 ft., erect, somewhat glaucous: lvs. ovate to ovate-lanceolate or sometimes oblong, acute, the upper ones acuminate and connate by their bases, very sharp serrate-dentate: inflorescence long and many-fld.: fl. 1 in. or more long, rose-purple or lilac, the narrow part of the tube about twice the length of the calyx, the upper part broad and full, the lobes rounded. N. Mex. to S. Calif. B.M. 5260.—A beautiful species.

EE. *Stem and lvs. more or less pubescent or hirsute.*

F. *Corolla 2 in. long.*

28. **Cobæa,** Nutt. Fig. 1716. Straight and erect, stout, about 2 ft., minutely pubescent: lvs. thick, ovate-oblong to oblong to broad-lanceolate, the upper ones clasping: inflorescence mostly simple and open: fls. very large, reddish purple to white, the base very narrow but the upper part of the flower broad and open, the limb only obscurely 2-lipped; sterile filament bearded. Prairies, Kans., south. B.M. 3465. Gn. 49:1068. Mn. 4:113.—Very showy, and probably one of the parents of the garden race of hybrid Pentstemons.

FF. *Corolla 1 in. or less long.*

29. **cristàtus,** Nutt. Only a few inches high, pubescent, usually viscid above: lvs. linear-lanceolate to narrow-oblong: inflorescence erect, leafy below: fls. about 1 in. long, purplish, rather abruptly dilated above, the lower lip bearded; sterile filament strongly yellow-bearded. Dakota to Colo. and N.—Good.

30. **ovàtus,** Dougl. Stem slender but erect, 2–4 ft., more or less pubescent: lvs. ovate, rather thin, bright green, serrate, the upper ones clasping: inflorescence

erect but lax, the peduncles 2–several-fld.: fls. about ⅔ in. long, blue changing to purple, 2-lipped and the lower lip bearded. Idaho, west and north. B.M. 2903.—Good.

31. **pubéscens,** Solander. Loose-growing, the slender often decumbent stems reaching 2 ft., usually viscid-pubescent: lvs. oblong to oblanceolate, small-toothed, the radical ones ovate to spatulate: inflorescence loose and open, the peduncles 2–3 in. long and the pedicels often 1 in. long: fls. about 1 in. long, drooping, dull purple or violet or varying to flesh-color, rather narrow, with 2 short lobes, bearded on the palate; sterile filament densely bearded. Dry fields and banks from Ontario south and west. B.M. 1424.—The common Pentstemon of the East, and useful in cult.

1716. Pentstemon Cobæa (× ¼).

AA. *Cells of anthers not dehiscing or opening to the base, the basal part remaining saccate.*

B. *Leaves dentate or serrate.*

C. *Plant viscid and soft-pubescent.*

32. **glandulòsus,** Lindl. (*P. staticifòlius,* Lindl.). Rather stout, 2–3 ft. tall: lvs. rather thin, ovate-lanceolate, acuminate, the upper ones clasping, the radical ovate or oblong, all toothed or serrate: inflorescence narrow, leafy below, the peduncles few–several-fld.: fls. large, somewhat over 1 in. long, lilac, with inflated throat, the lips short and broad; sterile filament glabrous. Idaho to Wash. and Ore. B.R. 15:1262; 21:1770. B.M. 3688.—Showy.

CC. *Plant not viscid, either glabrous or puberulent.*

33. **venùstus,** Dougl. Stem erect, nearly simple, leafy, 2 ft. or less tall, glabrous: lvs. thickish, oblong-lanceolate to ovate-lanceolate, very sharply serrate: inflorescence narrow, not leafy, the peduncles 1–3-fld.: fls. usually exceeding 1 in. in length, somewhat 2-lipped, light purple, somewhat hairy within; sterile filament hairy above. Idaho and Ore. B.R. 16:1309.

34. **diffùsus,** Dougl. Stems about 2 ft. tall, diffuse: lvs. ovate to oblong-lanceolate to cordate-ovate, unevenly and deeply serrate: inflorescence leafy, the pedicels very short: fls. ¾ in. long, light purple, 2-lipped; sterile filament hairy above. Ore., north. B.M. 3645. B.R. 14:1132. R.H. 1872:410.

BB. *Leaves deep-cut.*

35. **Richardsoni,** Dougl. Rather loosely branching: lvs. ovate-lanceolate to narrow lanceolate, deeply cut or pinnatifid, the upper ones not opposite: inflorescence loose: fls. ¾ in. long, light purple; sterile filament somewhat hairy at top. Ore. and Wash. B.M. 3391. B.R. 13:1121. L.B.C. 17:1641.

BBB. *Leaves entire.*

C. *Sterile filament somewhat bearded.*

36. **graciléntus,** Gray. A foot or more tall from a woody base, naked above: lvs. lanceolate to linear or oblong, glabrous: inflorescence loose, the viscid peduncles 2–5-fld.: fls. ½ in. long, violet-blue, the lobes very short. N. Calif., Nev., and Ore.

CC. *Sterile filament glabrous.*

37. **lætus,** Gray. About 1 ft. tall, from a woody base, closely pubescent: lvs. lanceolate to linear-lanceolate, the radical ones spatulate: fls. 1 in. long, blue. Calif.

38. **azùreus,** Benth. Erect or ascending, 3 ft. or less, glaucous, sometimes minutely pubescent: lvs. narrow-ovate to narrow-lanceolate: inflorescence loose and open: fls. 1½ in. or less long, blue to violet, sometimes reddish at the base, the limb about 1 in. across. Calif. B.M. 7504.

Var. **Jaffrayànus,** Gray (*P. Jaffrayànus,* Hook.). Lower (about 1 ft. tall), young stems tinged with red: lvs. oblong to oval or the upper ones ovate-lanceolate, glaucous: fls. large and showy, rich blue and reddish at base and in the throat. Utah to Calif. B.M. 5045. R.H. 1874:430.

39. **heterophýllus,** Lindl. Stems reaching 3–5 ft., from a woody base, the plant mostly green: lvs. varying from oblong-lanceolate above to lanceolate and linear below: inflorescence loose and open, the peduncles usually 1- or 2-fld.: fls. about 1 in. long, pink or rose-purple, very slender at the base but full or inflated above, the lips well marked. Calif. B.R. 22:1899. B.M. 3853. R.H. 1875:110; 1896, p. 348. L. H. B.

PEONY. See *Pæonia.*

PEPERÒMIA (Greek, *pepper-like*). *Piperàceæ.* An enormous genus of tropical herbs, mostly American, including some small but choice foliage plants for conservatory or house decoration. See Fig. 1717. Annual, or perennial by a creeping caudex or by tubers formed at the base: stems prostrate, creeping and thread-like, or erect and slender, or short, thick and succulent: lvs. alternate, opposite, or in whorls of 3–4 (rarely 5–6), entire, fleshy or membranous, often with pellucid dots: fls. minute, usually disposed in a dense spike, as in Fig. 1718; stamens 2; anther cells confluent; stigma sessile in the ovary.

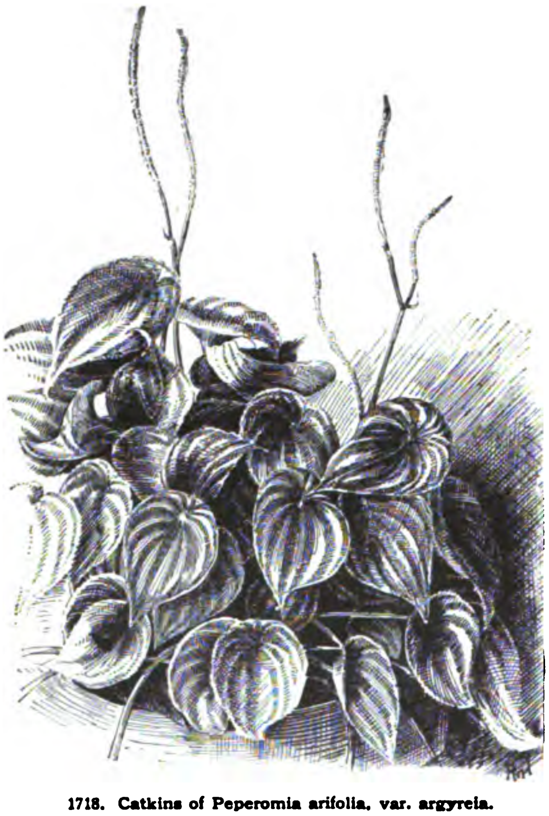
Speaking of *P. arifolia,* var. *argyreia,* J. D. Hooker says (B.M. 5634): "It is a very beautiful plant, and like so many of its congeners, is well adapted for placing along the edge of a shelf in a tropical house, both because of its beautifully marbled leaves and the length of time which these keep in good condition. In fact,

1717. Peperomia arifolia, var. argyreia.
A choice little house plant with variegated foliage.

few plants are better adapted for permanent bordering in tropical houses than Peperomias, their leaves varying so much in depth of colour, in marbling, in the different hues of their upper and under surfaces, and in the colour of their stalks; then, too, they are not attractive to insects, make no litter, and give very little trouble in propagating and cultivating."

The plant which seems to be the commonest in cult. here is the one figured in B.M. 5634 as *P. arifolia*, var. *argyreia*. However, DeCandolle thought that this plant was not the true *P. arifolia*, and he renamed it *P. Sandersii* (after Wilson Sanders), but the name is invariably spelled Saundersii in trade catalogues. The distinctions which DeCandolle makes are technical. The main ones are that *P. arifolia* has a short stem and catkins much longer than the lvs., while *P. Sandersii* has no stem and the catkins are about as long as the lvs. In some collections is a plant known as *Peperomia crassifolia*, a name that does not appear in botanical monographs. It is a very distinct species with dark green, ovate, fleshy lvs. 3 x 5 inches, becoming very hard when old; stems branched and upright in habit, a foot in height: fls. in insignificant catkins. It is a very good species and deserves to be more generally known. It is not in the trade, at least not under this name.

The names of Peperomias are much confused, partly owing to the vast size of the genus, which always increases the difficulties of discrimination, and partly to the minuteness of the fls. Moreover, the duration of many kinds is uncertain, while great numbers are monocarpic, that is, they flower and fruit once and then die. The latest monograph is in Latin. DC. Prod. 16, part 1, 392–468 (1869). For important criticisms on the key characters used by DeCandolle, see Hillebrand's "Flora of the Hawaiian Islands." W. M.



1718. Catkins of Peperomia arifolia, var. argyreia.

Peperomias are very attractive little plants, and their fleshy leaves enable them to endure the dry air of a living room much better than the great majority of plants. While they are essentially warmhouse plants, they will endure a coolhouse temperature for weeks without any apparent harm. They need shade in summer, but none in winter, and require less water than the general run of warmhouse subjects. Never keep them too wet. A loose, lumpy soil with a mixture of broken charcoal suits them well. A pan 3 or 4 in. deep is better for them than a deep pot. They are easily prop. in sand or sandy soil in a bottom heat of 75°, either by the leaf, as with *Begonia Rex*, or with an inch of stem attached. Early spring is the best time to propagate. *P. pubifolia* is well adapted for a hanging basket. *P. maculosa* makes a fine subject for a pan. These, together with *P. arifolia*, var. *argyreia*, and *P. marmorata*, are the best kinds for the florist. WM. SCOTT.

INDEX.

argyrea, 1.
argyreia, 1.
arifolia, 1.
brevipes, 9.
latifolia, 7.
maculosa, 4.
magnoliæfolia, 3.
marmorata, 6.
metallica, 5.
nummularifolia, 8.
prostrata, 8, 9.
pubifolia, 10.
Sandersii, 1.
tithymaloides, 3.
Verschaffeltii, 2.

A. *Plants for pots or pans.*
  B. *Lvs. alternate.*
    C. *Stems short or wanting.*
      D. *Foliage variegated.*
        E. *Base of lvs. rounded, not cut* .... 1. **arifolia**
        EE. *Base of lvs. heart-shaped*............. 2. **Verschaffeltii**
        EEE. *Base of lvs. acute*..... 3. **tithymaloides**
      DD. *Foliage not variegated* .. 4. **maculosa**
    CC. *Stems numerous, long, slender*...................... 5. **metallica**
  BB. *Lvs. opposite or in whorls.*
    C. *Base of lvs. with 2 roundish, overlapping lobes*... 6. **marmorata**
    CC. *Base of lvs. acute* .... 7. **latifolia**
AA. *Plants for hanging baskets.*
  B. *Lvs. roundish*................ 8. **nummularifolia**
    9. **brevipes**
  BB. *Lvs. ovate*....................10. **pubifolia**

1. **arifòlia**, Miq. (*P. argyrèa* or *argyræa*, Hort. *P. Sándersii*, C.DC.). Figs. 1717, 1718. Stemless: lvs. alternate, peltate, 5 x 3⅛ in.; petioles dark red, 4–8 in. long. Cult. only in the form var. **argyrèia**, Hook., which differs from the type in having broad, parallèl longitudinal bands of white between the nerves. Brazil. B.M. 5634. F.S. 23:2438. A.G. 19:17. F.R. 1:637.—Monocarpic annual or biennial.

2. **Verschafféltii**, Lem. Distinguished from *P. marmorata* by the basal lobes of the lvs., which do not overlap, but are separated by a notch as in a typical cordate leaf. A smaller and more delicate but more branched plant: stem short: stem, branches, petioles and peduncles much longer, translucent and pale rose (not green). Upper Amazon, Brazil. I.H. 16:598.

3. **tithymaloides**, A. Dietr. (*P. magnoliæfòlia*, A. Dietr.). Lvs. alternate, subovate, acutish, 2–3 in. long, base acute, more than 9-nerved; nerves subopposite; petiole 1 in. long, keeled beneath: stem rooting below. Santo Domingo.—Monocarpic annual or biennial.

4. **maculòsa**, Hook. Lvs. alternate (?) ovate-lanceolate, bright shining green, very fleshy; petioles beautifully spotted with purple. Santo Domingo.—A good subject for a pan. Perennial.

5. **metállica**, Lind. & Rod., is distinct from all others here described by its numerous slender, unbranched stems 12–16 in. high and lanceolate lvs. It probably belongs in some other genus or family. It was int. in 1892 before the fls. were known, and there seems to be no subsequent record of fls. Lvs. blackish green, painted white down the middle, red-veined below; petioles short, reddish brown. Peru. I.H. 39:157.

6. **marmoràta**, Hook. Stem short, much-branched, nearly ½ in. thick: lvs. opposite, ovate-cordate, deeply 2-lobed at the base, the lobes rounded and overlapping. The lvs. are 3–5 in. x 1⅛–2¾ in., not as broad as *P. arifolia* and less concave. Not adv., but has been unnecessarily confused with *P. arifolia*.

7. **latifòlia,** Miq. Stem 10 in. high, decumbent: lvs. obovate or obtusely ovate, 5–7-nerved, opposite or in whorls of 3, base acute, glabrous above, pubescent beneath; petiole 7–8 lines long. Sandwich Islands.—Monocarpic annual or biennial.

8. **nummularifòlia,** HBK. Delicate creeper, with long, thread-like, rooting stems and small orbicular lvs., puberulous or glabrate: lvs. alternate, ciliate, obscurely palmately 3-nerved, 3–4 lines in diam. Trop. Amer.—The above description is from Grisebach. Five other species in the West Indies have the same habit. *P. prostràta*, Hort., is probably a syn., but see *P. brevipes*. *P. prostrata* is a stove basket plant figured in G.C. II. 11:717 and F. 1881, p. 103, with a good-sized petiole. The lvs. are very small for the genus, and are said not to exceed two-fifths of an inch. Lvs. bordered and nerved with greenish white. Annual.

9. **brévipes,** C. DC. Lvs. alternate, orbiculate, younger ones hirsute, older ones glabrate, ciliate, 1-nerved: style none: berry with a very short stipe. Trop. Amer.—The above description from DC. Not advertised, but inserted because Nicholson refers *P. prostrata* to this species and keeps *P. nummularifolia* distinct.

10. **pubifòlia,** Veitch. Perennial creeper of unknown habitat, suitable for hanging baskets. Lvs. small, ovate, marked with a central gray bar.

P. resedæflòra, André, int. in 1865, was "found in all stoves" 2 years later and said to be "a plant for the million." It differs from all the above in being a flowering plant rather than a foliage plant, for the lvs. are merely bordered lighter green and the fls. are about as showy as those of a mignonette, each one 3–4 lines long, and 100 or so in a raceme. Stem 1–1½ ft. high, red, forked: lvs. broadly ovate, cordate. Colombia. B.M. 6619.

W. M.

PEPINO or **MELON SHRUB** is *Solanum muricatum*.

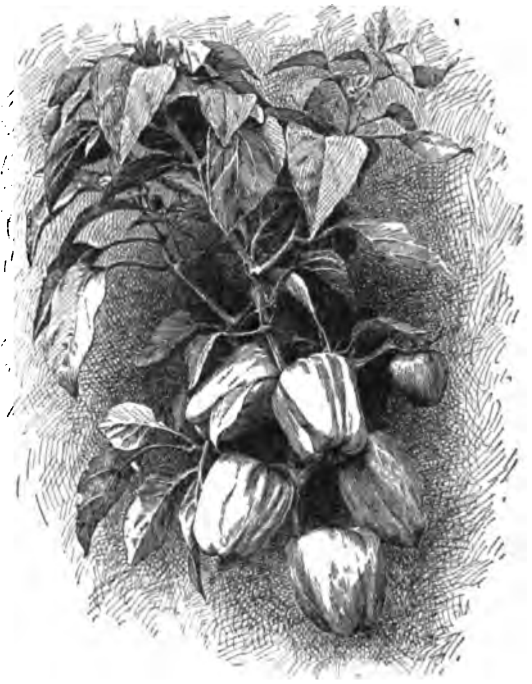
PEPÒNIA (Greek, *melon, gourd*). *Cucurbitàceæ*. Seven species of tropical perennial herbs, prostrate or scandent, often villous, with fibrous roots: lvs. lobed or rarely entire, dentate: fls. large, yellow or whitish, monœcious, the males solitary or racemose; petals 5, free, obovate; stamens 3; female fls. solitary: fr. large or medium. One species from Madagascar; the rest African. *P. Mackennii* was int. in southern California with the remark that it is an immense grower and has thick dark green foliage and yellow fls.; but it seems to have been lost from the trade for the present.

Mackénnii, Naud. Distinguished from its congeners by the following characters: lvs. broadly ovate-cordate, 5-lobed to the middle: male fls. solitary; calyx-tube subglabrous, narrowed from apex to base. It is hardly scandent, densely villous and the stem grows ½–6 ft. long: lvs. 4 in. long: petals over 1 in. long: fr. oblong-ovoid, about the size of a hen's egg, green at first, then marbled with white, finally all red; pulp orange-colored, insipid. Natal.

PEPPER. The black and white Pepper of commerce are treated under *Piper*. With American horticulturists "Pepper" usually means the red Pepper (Capsicum, which see) of which the green Pepper is merely the unripe stage.

The red Pepper is doubtless a native of the New World tropics, as there is no record of its having been known prior to the discovery of America. According to Irving's "Life of Columbus," this plant was first mentioned by Martyr in 1493, who says Columbus brought home "Pepper more pungent than that from Caucasus," evidently comparing it with the black Pepper of commerce from the oriental countries. It was cultivated by the natives in tropical and southern America before this time, and about a century later Gerarde speaks of its being brought into European gardens from Africa and southern Asia. The ease with which the plant spreads in warm latitudes, together with the increased commercial trade immediately following the discovery of America, doubtless caused a rapid dissemination through tropical Asia and Africa, where it was supposed by many to be indigenous and from there introduced into European gardens.

The first record of the use of Pepper is apparently by Chauca, physician to the fleet of Columbus, who in 1494 alludes to it as a condiment. Writers about a century later considered it valuable as an aid to digestion and also mentioned its use in dressing meats, dyeing, and other purposes. Medicinally it was much used for various ailments, such as dropsy, colic, ague and toothache, and when mixed with honey and applied externally was used as a remedy for quinsy. At a later date preparations were given for black vomit and various tropical fevers and for a tonic, also for gout, paralysis and other diseases. Its modern use is largely as a condiment, forming a seasoning in almost every dish eaten by the inhabitants of warm countries. The smaller varieties are mostly used for this purpose. The cayenne Pepper of commerce consists of the small pungent sorts reduced to a powder. The unground fruit is also made into Pepper sauce of various brands by preserving in brine or strong vinegar. The Tabasco variety furnishes the well-known Tabasco Pepper sauce and Tabasco catsup. "Chilli con carnie" consists of the small pungent varieties finely ground and mixed with meat. These hot varieties are often eaten raw by native Mexicans, as we do radishes, and also form an important ingredient of tomales so common in that country and fairly well known in the southern United States. The large, thick-fleshed sweet varieties are desired more by people farther north, who use them in various ways, served like tomatoes in either ripe or green state, with vinegar and salt, or made into mangoes by cutting one side, removing seeds and filling with chow-chow pickles. The parts are then tied together, placed in jars with vinegar and kept until wanted. The fruit is often used in stuffing pitted olives after being cooked in olive oil. In Spain some are canned after being thus cooked and eaten with French salad dressing. The seed of Peppers is more or less used as a bird food; and the plants of some varieties, like Little Gem and Celestial, are grown more especially for ornamental purposes.



1719. Pepper.
The Ruby King variety.

Some 30 varieties are recorded by American seedsmen. They differ from one another mainly in the form and pungency of fruit and habit of growth. There are endless forms among Peppers, but certain types are well fixed, as indicated by the botanical varieties under Capsicum. While all kinds are more or less pungent about the seeds, the pungency of most of the smaller sorts, like Coral Gem, Tabasco, Chilli, Cayenne, and Cherry extends to the fleshy portion, but as a rule the large kinds, like Ruby King (Fig. 1719), Squash, Bell, Sweet Mountain, and Golden Queen are sweet or very moderately pungent with the seeds removed. Some medium-sized varieties, like Long Red, Celestial, and Oxheart, are hot; others, like County Fair and Kaleidoscope, are mild.

As a rule Peppers are not grown in large quantities in any particular locality, but most gardens near large cities in the central and southern states grow a few to supply local markets.

1720. Pepper plant ready to transplant to the field.

In growing Peppers the seed is usually planted under glass in February or March, and the young plants transplanted to pots or boxes when of sufficient size to handle. From 12 to 20 days are required for the seed to germinate, the time varying according to the age of the seed and the manner in which it has been kept. Its germinating power is said to last four years, and if kept in pods until sown will grow when 6 or 7 years old. A light, warm soil, heavily charged with humus and one that will not quickly dry out, appears to be the best. In May or June, or after all danger of frost is past, the plants (Fig. 1720) are set in the field in rows about 2½ ft. apart and 18 in. apart in the rows. The ground is kept thoroughly cultivated, not only to keep down weeds but to maintain an even but not excessive moisture at all times, which is very essential for best results in growing this plant. By keeping the soil well worked up around the plants they stand up much better against the winds and weight of their own fruit. Pruning or pinching the tip ends after the fruit begins to mature is occasionally recommended, but is rarely practiced except when specimens of especially fine fruit are desired, in which case the fruit is thinned, leaving only a few on each plant of the larger sorts. In gathering, the fruit should not be torn off but cut with a knife or scissors, leaving at least one inch of stem. The usual vegetable crate is used for packing and marketing the crop.

Insects do not injure Peppers growing in the field. Red spider and greenfly (aphis) frequently attack plants growing under glass. The red spider may be kept in check by repeatedly syringing with water, and the greenfly may be killed by fumigating with tobacco dust. Two fungous diseases frequently occur on the large varieties growing outdoors. One is a pink anthracnose (*Glœosporium piperatum*), which causes the fruit to rot about the time it begins to ripen; the other is a dark anthracnose (*Collelotrichum nigrum*).

In preparing Peppers for table use, handle them with gloves to prevent burning the fingers. Neither soap nor water will soothe hands burned by Peppers, but milk will.

H. C. IRISH.

PEPPER GRASS. *Lepidium.*

PEPPERIDGE or TUPELO. See *Nyssa.*

PEPPERMINT. See *Mentha.*

PEPPERMINT STRINGY BARK. *Eucalyptus piperita.*

PEPPER ROOT. *Dentaria diphylla.*

PERAPHÝLLUM (from Greek *pera*, beyond, and *phyllon;* alluding to the crowded leaves). *Rosàceæ.* The only species is a much-branched rigid shrub, with deciduous, alternate, rather small and narrow lvs., white fls. similar to apple-blossoms, in few-fld. upright corymbs appearing with the lvs., and berry-like edible fr. Hardy as far north as Mass., but seems to possess only little ornamental value. It is of very slow growth and blooms only when rather old. It grows in well-drained soil and in sunny position, and is best suited to be planted on rocky slopes of southern aspect. Prop. by seeds and layers and by grafting on Amelanchier or Cratægus. It is closely allied to Amelanchier, but distinguished by its corymbose fls., cylindric calyx-tube, orbicular petals, and also by its narrow lvs. The only species is **P. ramosissimum**, Nutt., a rigid shrub, 2–6 ft. high: lvs. oblong to oblanceolate, almost sessile, entire or sparingly serrulate, silky pubescent when young, ¾–2 in. long: fls. in few-fld. erect corymbs, white or slightly tinged pink, with rose-colored disk, ¾ in. across; petals orbicular spreading; styles 2–3: ovary 2- or incompletely 4-celled: fr. pendulous, globose, brownish yellow, about ½ in. across. May. Ore. to Calif. and Colo. B.M. 7420.

ALFRED REHDER.

PERENNIALS tend to live from year to year, as opposed to annuals and biennials, which die root and branch the first or second year after flowering and fruiting. Perennials include trees, shrubs and herbs, the two former being woody, the latter not. "Perennials" as commonly used by gardeners is a convenient shortening of the phrase "hardy herbaceous perennials," which includes Peony, Phlox and other non-woody plants whose roots live over the winter while their tops may die to the ground. The phrase "hardy herbaceous perennials" is also shortened in common speech to "herbaceous plants;" or one speaks of his "hardy border." See *Herbs* and *Border*.

A popular fallacy about Perennials lies in the common statement that "they die down every year and come up again in the spring." Many of them never come up. Peonies are as long-lived as shrubbery, and a clump of Fraxinella has been known to outlive father, son and grandson in the same spot. But these are exceptions. The general practice with Perennials is to divide them every second or third year. Nearly all hardy herbaceous plants should be lifted now and then, because the crowns which give the flowers in most desirable kinds flower only 2 or 3 seasons and then die; but the plant may be continually spreading and making new growths, which furnish the flowers, and unless lifted and divided the stocks become scattering and unattractive. Another very good reason for lifting and dividing the Perennials is that, being mostly strong-rooted plants, they deplete the soil.

PERÉSKIA (Nicolaus Fabricius Peireskius, of Aix, France). *Cactàceæ.* Also written *Peireskia.* Shrubby, the slender, often very long branches spreading or climbing; spinose, but the spines not barbed and setæ wanting: lvs. broad, sometimes much like those of the lemon tree: fls. wheel-shaped, more or less paniculate at the ends of twigs; ovary leafy: seeds dark, thin-shelled, with two coverings.

aculeàta, Mill. LEMON VINE. BLAD APPLE. BARBADOES GOOSEBERRY. Branches woody, rather slender, becoming 10–20 ft. long: lvs. pinnate-veined, 2–3 in. long, 1–2 in. broad: spines at first 2 intra-axillar, short and hooked, later numerous and 1–2 in. long: fls. very pale yellow, sometimes pinkish, 1–1½ in. broad, somewhat panicled at the ends of the branches: fr. lemon-color, the size of an olive, at maturity nearly or quite smooth. Widely spread in tropical America. B.M. 7147. G.C. III. 20:625.—This species is much used as stock on which to graft other species of Cacti.

Blèo, DC. Fig. 309, Vol. I. Stems stouter, more succulent, less branching: lvs. often 5 in. long by half as wide: spines at first commonly solitary in the axils, later more numerous, all straight: fls. purple, 1½–2 in. broad: fr. 2 in. long, pear-shaped. New Granada, Brazil. B.M. 3478. G.C. III. 20:427.

subulàta, Muehl. Stem 2 ft. or less high, below half wood, above fleshy and branching: lvs. persisting a few years, dark green, shiny, as thick as a pencil, about 3 in. long, half cylindrical and ending in a spine: areolæ felted, in the young plant with a few hair-bristles later with 2–4 straight, pale yellow spines 3–4 in. long. Chile.—Can be used as stock for Epiphyllum.

spathulàta, Otto. Stem upright, with few horizontal, spatulate, shiny green leaves: the diffuse areolæ at first somewhat woolly, later felted, above with a bunch of short bristles, below with 1–2 yellowish white, straight spines. Mex.

KATHARINE BRANDEGEE.

PERFUMERY GARDENING. The perfumes of the market are derived in part from animal secretions (musk, civet), in part from artificial chemical compounds, and in part, and chiefly, from the class of vegetable products loosely called essential oils. "Synthetic" or chemical perfumery materials are the more or less perfect artificial reproductions of organic compounds used in perfumery. If it were possible in all cases and with perfect success to compound these substances the production of floral perfumes would soon be at an end, as the chemical process would be sure to be cheaper than the horticultural. But nature knows how to add some touches which the chemist's art cannot imitate, and even where synthetic manufacture is possible, the result is in general regarded as a cheaper substitute. At the same time, sentimental reasons count considerably in favor of the natural perfume, and considering, further, that some perfumes cannot be imitated chemically, there is no present cause to apprehend the extinction, or, in view of increasing demand, even the decline, of the industry of producing natural perfumery oils.

The essential oils used in perfumery are secreted in different parts of the plant. The flowers are naturally thought of first, being the seat of the fragrance of the rose, violet, cassie, jasmine, tuberose, the orange in part, and numberless other plants whose perfume is extracted or only enjoyed as naturally exhaled. The oil of lavender is yielded more by the green parts of the flower-head than by the corollas. In rose geranium, thyme, wintergreen and patchouli the foliage is the fragrant part. A number of essences are derived from woods, as those of sandalwood, red cedar and rhodium. The oil of sweet birch comes partly from the wood, but mainly from the inner bark, and the same is true of sassafras. In the case of the latter, however, the roots only are used; in the case of the former the young tops. Several herbaceous roots also furnish oils, as orris root, Canada snakeroot and sweet flag. The rinds of the orange and other citrous fruits contain important perfumery oils, and the oil of bitter almonds comes from the fermented kernel of the nut.

The standard methods of extracting essential oils are four, namely, the use of mechanical means (chiefly expression), distillation, *enfleurage* or inflowering, and maceration. Expression appears to be applied only to the rinds of the citrous fruits. These are placed under pressure in a screw press, or sections turned wrong side out are squeezed in the fingers, the oil being taken up with a sponge, or the fruit is rubbed in a cup lined with spikes (*écuelle à piquer*), the oil collecting in a hollow handle. An *écuelle* on a larger scale in the shape of a hollow drum has also been used.

In distillation, the oil-bearing material is heated with water or subjected to hot steam, and the oil, being volatile, passes off with the steam. The oil would be lost if the vapor were not condensed, and this is accomplished by passing it through a coil or equivalent arrangement of pipe kept cool by a flow of water. The condensed steam and oil fall into a "Florentine recipient," a vessel with a spout coming out at the base but rising to the level of the top, so that the heavier liquid, sometimes oil, sometimes water, alone will enter it and can be poured off separately. After the water and oil have mainly separated, the water will still contain enough oil to make it highly fragrant, and in this state it goes to market as rosewater, orange-flower water, etc., or is returned to the still to be redistilled with the next charge.

The remaining two methods depend on the fact that grease has the power of absorbing essential oils. In *enfleurage* the grease, without heating, is spread over both surfaces of panes of glass which are set in frames (*châssis*), so that they can be piled one over another with spaces between. In these spaces are placed the flowers, the charge being renewed daily until the grease is sufficiently impregnated, when it constitutes a "pomade." "Extracts" are made by digesting the pomade in alcohol, which has a still stronger attraction for the perfume than has the grease. The alcohol must first be deodorized to save perverting the floral perfume, and is then known as "Cologne spirit." The grease used in this and the next process, moreover, must be freed from all corruptible matter by a special process. Tallow and lard, commonly mixed, and sometimes the fat of the deer and other animals, are employed.

In maceration the pomade is produced by immersing repeated charges of the flowers in melted grease or fine olive oil.

In recent times various chemical processes for extracting perfumery have been tried, apparently with some practical success; but they have not yet supplanted the old methods. Carbon bisulfid and petroleum ether are among the solvents employed. These methods would be less easily practiced by beginners and amateurs than the ordinary ones.

The art of distilling is not only not difficult to learn, but is already in practice in this country in the case of peppermint, sweet birch, sassafras, eucalyptus, etc. More care and better apparatus would be required for distilling roses and other flowers, but the process is essentially the same. Nor do the grease processes involve any difficulties which may not be overcome by the application of a little American ingenuity and capital. In fact, the production of the raw materials of perfumery might proceed almost at once, so far as the difficulty of the processes is concerned. But can we grow the requisite plants?

That many of the standard perfumery plants will grow in this country needs no proof, and there is no reason to doubt that their fragrance in properly chosen localities will equal that of the same plants in the European centers. In general, success in this line must be looked for only southward, even in dealing with hardy plants, though there may be exceptions to this rule. Cool trade-winds and fogs at flowering time are to be shunned. The natural conditions in Florida seem not very different from those of the south of France, the great center of perfumery farming in Europe, and in fact the feasibility of successful perfumery farming in Florida has been demonstrated by actual trial. California has also been the scene of experiments, some of them seeming to promise success as soon as economic conditions admit. A large territory between these two points is available for some lines of the industry.

Among the particular plants to be noticed, the citrous fruits deserve a leading place. Nearly or quite all of the trees of this group, including the sweet, the bitter or Seville, and the bergamot oranges, the sweet and sour limes, the lemon, the citron, and the shaddock, contain valuable perfumes either in the peel of their fruit, or in their flowers, or in their leaves, or in more than one of these. Of the fruit oils, that of lemon is imported into this country in largest quantity, followed by oil of bergamot, oil of orange bitter and sweet, oil of limes and "cedrat" or citron oil, the last two in very small quantities, but the cedrat at a very high price. These oils are extracted by expression, the distilled being inferior, though it is asserted that when the "rag," or inner soft layer, is removed, the distilled oil equals the other. The oil of the bitter orange is superior to that of the sweet; the oil of bergamot is far more valuable than either, but can rarely be had in an unadulterated state. The flowers of the orange treated by distillation yield "neroli." The scent of neroli, however, is not that of the flowers, an alteration taking place during the distillation. Orange-flower water, consisting of the condensed vapor of water with a little unchanged oil adhering, affords the true odor of the flowers. By maceration, likewise, the true floral fragrance is obtained. The abortive flowers which fall from the trees are available for perfumery use, but the flowers are also sometimes picked, presumably with a better result. Besides the product of fruit and flowers, the leaves and young twigs pruned from the sweet and bitter oranges yield to distillation the oil of "petit grain," of considerable though minor value. There is no reason to doubt the perfumery capacity of American orange groves. Indeed it has been asserted that the orange flowers of Louisiana excel in sweetness those of foreign parts. In Los Angeles, California, something has been done towards utilizing the peel, and in Florida a beginning has been made with both peel and flowers, but for the most part these resources are at present suffered to go to waste.

The lemon verbena, *Lippia citriodora* (Fig. 1721), may be mentioned in passing as furnishing an attractive perfume of the citrous order, and as available at least in Florida and California.

The perfumery products of the rose and its allies merit next attention. The value of the importation of attar of roses—to say nothing of rose perfume in other forms—exceeds that of any single citrous perfume, and at the same time the capacity of this country for producing this and the other rose perfumes can scarcely be called in question. The present supply of the European and American markets is derived chiefly from Turkey and from the perfumery region of the south of France. The attar or otto of roses is produced most largely in Bulgaria and other parts of European Turkey, from the damask rose. It is obtained by distillation, which is there conducted in a rude manner. In the Grasse district (south of France), the rose water, obtained as explained above, yields more profit than the attar, which is regarded as a by-product of the distillation. But the rose perfume is here largely extracted by maceration, finishing with enfleurage, processes which secure the true rose odor, which is not represented by the attar or water. The pomade and its alcoholic extract are perhaps the finest of rose products. The Provence rose is here employed, a hybrid or variety of the hundred-leaf, *Rosa centifolia*, the type to which the cabbage and moss roses belong. Pictures of this rose present, not the well-known dooryard variety with short and crowded petals forming a flat disk without visible stamens, but a variety with larger and looser petals of a deeper color, with stamens in the middle. Both this and the damask rose are spring bloomers, the latter yielding also a small crop in the fall.

The luxuriance of roses on the Pacific coast and through the South invites experiments in those regions to ascertain their perfumery worth. Affluent vegetation cannot be taken as sure proof of a rich perfumery content, but this must be directly investigated by the nostrils and better by experimental distillation. There is practically no doubt, however, that in properly chosen localities American roses can compete in sweetness with the European. How far north the rose can be utilized for perfume cannot be settled in advance of experiment. The rose must have a hot sun, but the June sun is hot far to the north; and as at most only two harvests are gathered each year the advantage of the South may not be as great as might be supposed. Still the presumption is that our coming rose industry will be conducted in our warmer sections. The soil for the rose must not be poor, but there is a possibility of its being too rich for the best perfumery results. While distillation seems to be practically confined to the two roses mentioned above, other kinds whose odor is attractive are available for treatment by the grease processes. There appears to be little in the methods of cultivating roses for this purpose which would not suggest itself to an experienced gardener. It takes some 3,000 pounds of petals to yield a pound of oil, but that pound should be worth at retail about ninety dollars, and more if of extra quality.

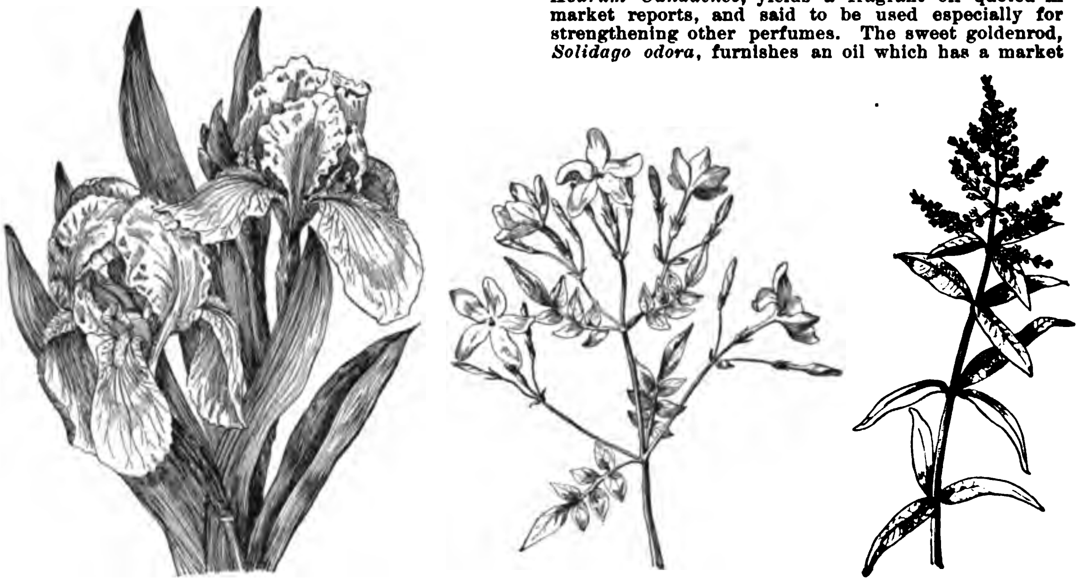
The oil distilled from the green parts of the common rose geraniums, *Pelargonium capitatum* (?) and *P. Radula*, resembles in fragrance the oil of roses and is largely used as a substitute for it. Though generally not sold at retail under its own name, it is in itself a legitimate perfume, and its production should be undertaken in this country—only, however, in the South, where the long season admits of three crops of leaves and where the stumps with the soil heaped around them will survive the winter. The largest crop is to be had on rich lowland, but the finest quality is produced on drier and less fertile ground. In France, it is now grown mainly on irrigated land, but the product has to be ameliorated by the admixture of oil from drier locations. The rose geranium is largely grown in Algeria, and in Spain, Sicily, etc., as well as in France. Geranium oil in turn has its substitutes, among which the oil of lemon grass from India is conspicuous.

The European sweet violet, *Viola odorata*, affords the finest example of a favorite type of odors quite different from the citrine and the rose. The oil of the violet itself is necessarily so expensive as to be little used. The large amount of flowers required and the amount of hand labor necessary for gathering such small flowers, each growing on a separate stem, are apparently insurmountable obstacles to the extensive use of true oil of violet. Still it may be presumed that there will permanently be a class of buyers willing to pay the necessary cost of so choice a perfume. The violet yields its full fragrance only southward, but it must be grown in partial shade. When labor conditions admit, true violet perfume may be produced in California and in the South. An expert grower of violets has even thought that they might be grown under glass for this purpose.

Of the same general type and in some wise a substitute for violet perfume, is that of *Acacia Farnesiana*, the "cassie" of the French, known in the South as "opoponax." The small yellow balls of flowers are treated by the grease processes, particularly maceration. While not ranked as high as violet, the perfume is in entirely good standing and produced in large quantities. The flowers dried with proper care have a market value for sachets. The opoponax tree grows freely in Florida, is apparently native in Texas, and is suited to the climate of Arizona and southern California. The labor of picking the flowers would be somewhat expensive. Several other acacias are eligible for perfumery use.

To the same group belongs the perfume of orris or iris root. It is afforded by the rootstocks of three species of Iris, formerly gathered wild and now cultivated near Florence and at other points in Italy. The species are *Iris Germanica* (Fig. 1178), *I. pallida*, and *I. Florentina* (Fig. 1721), the first of these being our common garden Iris, with deep blue flowers, the second a paler-flowered species, the third having white flowers. High authority affirms that the use of the first two species is only a falsification, and in fact that the root of *I. Germanica* causes serious inflammations. It is certain that the first two are extensively grown; but *I. Florentina* alone appears to be much used for distillation. When cultivated the Iris is generally propagated by root division, the cuttings being placed for the first year in a nursery, afterward set in rows a foot apart. It is grown in stony dry soils on hillsides or mountains. The crop is gathered once in two or three years. The cuticle is scraped from the root, which after being dried in the sun is stored in a dry place for the development of its fragrance. This is wanting in the fresh root, and does not reach its maximum under three years. When distilled the root yields "orris butter," but it is more largely used in the form of an alcoholic tincture or ground up for sachets. There is no reason why orris root should not be grown in many parts of this country, but the returns at present are not large.

Another important group of perfumery plants consists of several members of the mint family. Peppermint and spearmint (Fig. 1392) can hardly be placed in the perfumery class, but lavender, thyme and rosemary could not easily be spared from the perfumer's resources. Lavender is native on dry slopes in the Mediterranean region, and the oil is most largely produced in the region of the maritime Alps. The plant has been introduced, however, into some of the southern counties of England (Mitcham and Hitchin being the centers), and found to produce there an oil which has commonly been regarded as far superior to the French, and at any rate is different in kind (see *Mentha*). The English lavender is grown in light and well-drained calcareous soils. In well-drained ground lavender will bear some cold, especially if protected, but profit cannot be looked for far north. Lavender of the French type may be expected to succeed in California out of the reach of the trade-winds, and may perhaps not require irrigation. There are shallow calcareous soils in the "black belt" of the Gulf states which might perhaps yield an oil like the English, and the same may be true of some tracts northward on the Pacific slope. Lavender is treated by distillation, and it is said in England that direct contact with the water yields better results than the application of dry steam. (See, also, *Lavandula.*)


1721. Perfumery plants: Iris Florentina; Jasminum grandiflorum; Lippia citriodora.

Thyme (chiefly the garden thyme, *Thymus vulgaris*) furnishes a perfume particularly suited to soaps and imported into this country in large quantities. Rosemary has a stimulating property and is an essential ingredient in Cologne water. Both of these could quite possibly be grown, say in California, but might not be able to compete well with the spontaneous product of Europe.

Some notice should be taken, too, of the rather humble group of odorous plants belonging to the parsley family, including anise, caraway and fennel. Not only are the oils of these three (chiefly anise) largely imported, but also their seeds (chiefly caraway). Caraway runs wild northerly, fennel has established itself on the lower Potomac, and anise could doubtless be grown, but there is no reason to expect large profits from these plants.

There are several plants deserving consideration which do not fall into any of these groups. One is the jasmine (*Jasminum grandiflorum* and *J. Sambac*). Fig. 1721. This furnishes almost the only odor which cannot be imitated by combinations of others. The oil of jasmine is very valuable. The plants can be grown in our warmest regions. The tuberose furnishes another choice perfume and has been very successfully grown for the purpose in Florida. (See *Polianthes.*) The heliotrope (Fig. 1032), jonquil (Fig. 1460), and mignonette are also to be named. Of a quite different scent from any of these is the oil of bitter almond, so important for fine soaps. This so-called oil is a poisonous compound formed in the process of fermenting the cake of the kernels from which the fixed oil has been expressed. Its production should be considered in our almond-growing regions, especially California.

Of our native growths there are some which are already utilized as the source of scenting materials. The root of sassafras is or has been distilled in Pennsylvania, Maryland and Virginia, and in other northern states, and sparingly southward. Wintergreen, *Gaultheria procumbens*, was formerly distilled in the North, but has given place to sweet or cherry birch, *Betula lenta*, which yields the same oil less expensively. The wood of the red cedar, *Juniperus Virginiana*, has long been distilled in Germany, and latterly in this country. It furnishes a finer cedar-of-Lebanon perfume than the cedar of Lebanon itself.

The root of the wild ginger or Canada snakeroot, *Asarum Canadense*, yields a fragrant oil quoted in market reports, and said to be used especially for strengthening other perfumes. The sweet goldenrod, *Solidago odora*, furnishes an oil which has a market standing. The rich odor of the yellow jessamine of the South has been successfully extracted in Florida. The common market perfume of magnolia is doubtless mostly or entirely an imitation, and the same is probably true of *Clethra alnifolia* perfume. The great magnolia, *Magnolia grandiflora*, abounds in the South, but its flowers might be difficult to secure in quantity. Clethra is abundant enough in the Atlantic coast region, but some difficulty might be experienced with it owing to the fact that only a part of the flowers in the raceme open at one time. The flowers of the swamp magnolia or sweet bay, *Magnolia Virginiana* or *M. glauca* (Fig. 1347), should be tried. The spice bush, *Benzoin odoriferum*, affords several scents. The sweet and copious bloom of *Azalea arborescens* in the southern mountains has been suggested for treatment. It is to be feared that the delicious odor of the native crab apples would be too expensive, considering the difficulty of collecting enough petals. The bloom of the wild grape might well be thought of. Many of our plants—these are only examples—will eventually be tried and a few will be found steadily valuable. It is useless to expect commercial success with small and scanty-flowered plants like trailing arbutus, *Epigæa repens*, however pleasing in their natural state.

The production of perfumery oils may be conducted on large farms by capitalists; or a central establishment may contract with individuals for flowers and other materials; or the business may be carried on coöperatively; or individuals may operate on a small scale in connection with other lines of farming. Some competent women to whom other avenues are closed may find this work available and congenial.

Intending experimenters should seek further information in one or more of the books which are before the public. With regard to methods of extraction, Askinson's "Perfumes and their Preparation" may be confidently recommended. Sawer's "Odorographia" (especially the first series) is valuable both to the extractor and the grower. Piesse's "Art of Perfumery" will also be found useful on both sides of the subject. Gildemeister and Hoffman's "Volatile Oils" is also very valuable.
E. S. STEELE.

Also consult E. S. Steele's article on "Perfumery Gardening" in the Yearbook of the U. S. Dept. of Agric., for 1898. Vol. 22, part 2 of the Journal of the Royal Hort. Soc. (London, 1898) contains a list of perfumes and plants that yield them, and also a list of books on perfumes.

PERÍLLA (said to be a native name in India). *Labiàtæ.* *Perilla Nankinensis* is distinct among all tender bedding plants by the color of its foliage. The leaves are a dark, wine-purple, with a bronzy luster. These colors are more or less toned with green, especially in young plants. The Perilla is an annual herb, growing about 1½ ft. high. It is considerably used in subtropical beds and for the back of ribbon borders. It is sometimes planted next to a dusty miller or other white-leaved plants for the sake of contrast. The foliage has an odor suggesting cinnamon. In Japan the Perilla is of economic importance for the production of oil. Perillas need a sunny or at least half-sunny position. They thrive under the treatment given half-hardy annuals. Sow the seeds thinly and cover nearly an inch. Avoid planting Perillas too closely; leggy specimens are wretched. The fls. are inconspicuous and produced in autumn. Before the introduction of the Coleus, this plant was much used as an ornamental flower-garden plant, and is still used largely in the gardens of northern Europe, where the Coleus makes but a stunted growth. But in our warmer summers it is displaced by the more brilliantly colored and free-growing Coleus.

Perilla is placed by Bentham and Hooker next to the American genus Collinsonia, with which it agrees in the following characters: flowering calyx of 5 nearly equal teeth; fruiting calyx declinate, 2-lipped; anterior lobe of the corolla larger; perfect stamens 4. The main point of difference lies in the nutlets; those of Perilla are netted-veined, while those of Collinsonia are smooth. Also the anther cells of Collinsonia are divaricate, while those of Perilla are finally merely divergent. Perilla is placed in the same subtribe with Mentha, but belongs to a group in which the whorls of fls. are not axillary (as is usually the case in the Mentha group), but are spicate or racemose.

ocymoides, Linn. Also spelled *ocimoides*. The typical form has lvs. green on both sides and is worthless for gardens. Lvs. opposite, rarely speckled with brownish purple, only slightly wrinkled, base wedge-shaped or narrow; blade broadly ovate or roundish, pointed or blunt, hairy or not, entire or variously cut at the margin. In the wild, it is a coarse, often shaggy plant, 2–4 ft. high, with lvs. 3–6 in. long, petioles 1–3 in. long: racemes 3–8 in. long: corolla white or reddish, 2 lines long: fruiting calyx ½ in. long. Himalayas, Burma, China, Japan. B.M. 2395.—Sparingly run wild.

Var. **Nankinénsis,** Voss (*P. Nankinénsis*, Decne. *P. argùta*, Benth.). Slightly hairy, rarely glabrous: lvs. dark purple-brown, with a bronzy luster; base wedge-shaped (rounded in strong-growing specimens); blade ovate, acute, coarsely and deeply saw-toothed, margin wavy. Occasionally seedlings are green when young. R.H. 1852:60; 1879, p. 272. Forms of this variety are: (1) Var. **laciniàta** (*P. laciniàta*, Hort. Thorburn. *P. Nankinénsis fòliis atropurpùreis laciniàtis*, Hort. Benary) has lvs. cut nearly to the middle, foliage undulate, wrinkled or crisped. Colors said to be more intense. Int. about 1872. P.G. 2:77. (2) Var. **macrophýlla** (*P. Nankinénsis macrophýlla compácta*, Hort.) is a large-lvd. form characterized by its almost "bell-shaped" form. The lvs. are wavy-fringed. Habit compact. (3) Var. **elàtior** (*P. Nankinénsis macrophýlla elàtior*, Hort. Benary) is a taller form of var. *macrophylla*. (4) Var. **variegàta** (*P. Nankinénsis foliis variegatis*, Hort.) differs in having the foliage spotted with white. (5) Var. **microphýlla** (*P. Nankinénsis microphýlla nigricans*, Hort. Benary) is a small-lvd. form int. about 1899.
WM. SCOTT and W. M

1722. Peristeria elata—Holy Ghost Plant. (Flower × ½.)

PERÍPLOCA (Greek, *peri*, around, and *plekein*, to twine; alluding to the twining habit). *Asclepiadàceæ.* Twining, rarely upright, glabrous shrubs, with opposite, deciduous or evergreen entire lvs. or sometimes leafless, and with rather small usually dark-colored fls. in axillary or terminal cymes. Most of the species are subtropical, but the only species cult. in this country is hardy north to New York, and can be grown even in Canada when trailing on the ground and somewhat protected during the winter. It is a vigorous and high-growing climber, with handsome dark green and shining foliage, and is well suited for covering arbors, trellis work and trunks of trees. It bears fragrant fls. in summer and keeps its foliage until late in fall. It thrives in any well-drained soil and prefers sunny positions. Prop. by seeds or by greenwood cuttings in summer under glass; also by layers.

Twelve species, distributed from S. Eu. to trop. Africa, China and E. India. Shrubs, with milky juice: fls. in axillary or terminal cymes: calyx 5-lobed; corolla 5-parted, bearing inside at the base a 5- or 10-lobed crown; stamens 5, with very short filaments and with the anthers connected at the apex and villous; style short, with broad stigma: fr. consisting of 2 follicles, containing numerous, small, winged seeds.

Græca, Linn. SILK VINE. Deciduous shrub, twining to 40 ft.: lvs. petioled, ovate to oblong-lanceolate, acuminate, dark green and glossy above, 2–4 in. long: fls. in loose, long-peduncled cymes, brownish purple inside, greenish at the margin and outside, ¾–1 in. across; petals oblong, villous; crown with 5 slender thread-like incurved glabrous appendages: follicles narrow, about 4 in. long. July, Aug. S. Eu., W. Asia. B.M. 2289. B.R. 10:803. L.B.C. 14:1389. Gn. 34, p. 78. —Under the name of *P. angustifolia* a narrow-leaved form is sometimes cultivated, but it is *P. Græca*, var. *angustifolia*, Jäg. The true *P. angustifolia*, Labill., is synonymous to *P. lævigata*, Ait., from the Canary Isl. and N. Africa, with persistent lvs. and pubescent appendages of the crown.

ALFRED REHDER.

PERISTÈRIA (Greek, *dove*, from the form of the column and wings). *Orchidàceæ.* A genus of stately South American orchids, having large plicate leaves unfolding successively, and tall, erect or hanging flower-spikes. The flowers are nearly globose or cup-shaped, of a waxy texture, with broad, concave segments. The genus is distinguished from the related genera Acineta, Sacæna, Gongora, etc., by the curious shape of the labellum and column. The base of the labellum (hypochil) is united with the column by broad wings (pleuridia). The upper part of the labellum (epichil) is movably joined to the hypochil. Five species, of which two are commonly cultivated.

These plants are easily kept alive, but difficult to flower. When growth begins they should be planted in well-drained compost of fibrous loam, leaf-mold and sand, and carefully watered until the plants become vigorous. Later liquid manure or bone-dust may be given them in order to obtain large and vigorous flower-spikes. Liberal treatment will produce fine specimens, but poorly fed plants often fail to flower at all. When resting, they should be removed from the tropical house to a cooler room. *P. elata* is often grown as a purely terrestrial orchid.

elàta, Hook. DOVE FLOWER. HOLY GHOST FLOWER. Fig. 1722. Pseudobulbs 4–5 in. high, bearing several strongly veined lvs. 2–3 ft. high: fl.-stem 3–4 ft. high; fls. in a raceme covering about one-third the length of the flower-stalk, cup-shaped, creamy white, wax-like and fragrant, 2 in. across; sepals broadly ovate to rotund; petals more delicate; labellum fleshy, broadly obovate, truncate, sprinkled with deep purple; column with large, curious wings, supposed to bear resemblance to a dove, June–Sept. Panama. B.M. 3116. Gng. 5:151. V. 8:163. Gn. 12, p. 153; 30, p. 574; 42, p. 324. R.H. 1876, p. 133; 1877:110 —The labellum and wings of the column are sometimes spotted with purple.

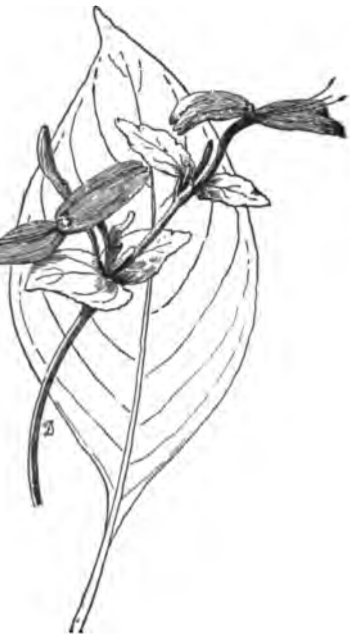
péndula, Hook. Pseudobulbs ovate-oblong, 4–5 in. high, bearing lanceolate, strongly veined lvs.: scape pendulous, from the base of the pseudobulb, bearing as many as 20 fls.: fls. globular in outline, 1½ in. across, fragrant, greenish white outside, tinged with rose and thickly dotted with purple within; sepals roundish concave, united at base; petals rather smaller; labellum fleshy, curiously shaped, enclosed within the flower. Guiana. B.M. 3479. G.C. II. 25:116.—Requires tropical treatment, but rarely flowers in cult.

P. Húmboldtii, Lindl.—Acineta Humboldtii, Lindl.

HEINRICH HASSELBRING.

PERÍSTROPHE (Greek, *peri*, around, and *strophos*, belt; alluding to the involucre). *Acanthàceæ.* Erect branched or loosely creeping herbs or half-shrubby greenhouse plants cult. for their flowers. Lvs. entire: fls. solitary or in clusters of 2–3 surrounded by an involucre, in loose cymes or cymose panicles, or distant on slender branches; bracts of the involucre narrow; calyx deeply 5-parted, shorter than the bracts, scariose or hyaline; corolla-tube long, slender, slightly enlarged above, limb deeply bilabiate, the posterior lip narrow, erect, concave, entire or emarginate, lower lip spreading, apex 3-parted; stamens 2, a little shorter than the corolla lips; anthers 2-celled; sterile stamens none; style filiform: capsule oblong, contracted into a solid stalk. About 15 species, ranging from tropical Africa through the Malay Islands and Australia to India.

The plants are cult. like Jacobinias or Justicias, of the same family. Cuttings taken at any time when the wood is soft will root in a warm bed in 3–4 weeks, after which the potted plants may be removed to a house of lower temperature. They require a rich loam mixed with some leaf-mold, and plenty of air.



1723. Peristrophe speciosa (× ½).

speciòsa, Nees (*Justicia speciòsa*, Roxb.). Fig. 1723. Plants erect, spreading and branched, becoming 2–3 ft. high: lvs. opposite, petioled, ovate-acuminate, smooth: fls. in clusters of 2–3 on slender branches, violet-purple, 1¾ in. long. Fls. for a long period in winter. India. B.M. 2722. L.B.C. 20:1915. B. 2:74.—A pot-plant of bushy, compact habit when well grown. Good for the window. Usually thrives best in partial shade.

angustifòlia, Nees. Plants low, erect, very much branched: branches nearly horizontal, pubescent above: lvs. lanceolate, pointed at both ends: fls. sparse, in terminal cymes, rose-colored. Flowers freely. Java.—A var. **àurea variegàta** has the center of the lvs. variegated with yellow. Useful for vases and baskets.

HEINRICH HASSELBRING.

PERIWINKLE. *Vinca.*

PERNÈTTYA (after A. J. Pernetty (1716–1801); he accompanied Bougainville on his voyage and wrote "A Voyage to the Falkland Islands"). *Ericàceæ.* Ornamental low evergreen shrubs, with small, alternate, usually serrate lvs. and small, white or pinkish, nodding fls., usually solitary in the axils and followed by very decorative berries varying in color from white to purplish black or bluish black and remaining on the branches all winter. These exceedingly pretty shrubs are great favorites in England, but are little known in this country. *P. mucronata* and *P. angustifolia*, the hardiest, are probably hardy in sheltered positions as far north as New York. They are well suited for rockeries and borders of evergreen shrubberies and also make very handsome pot-plants. They grow best in a peaty and porous moderately moist soil and prefer sunny positions, but seem to grow almost as well in any other well-drained soil; in shade they will not fruit as profusely as in the full sun. Prop. by seeds or by cuttings of half-ripened wood in summer under glass; also by means of layers and suckers. Grown chiefly for the ornamental fruit.

About 25 species from Mexico to the Magellan region, mostly in the mountains and 1 species in Tasmania and New Zealand. Fls. axillary, usually solitary on slender nodding pedicels, rarely in racemes; calyx 5-parted; corolla urceolate, with short 5-lobed limb; stamens 10, the anthers 4-awned at the apex: fr. a 5-celled many-seeded berry. Allied to Gaultheria, but the calyx not enlarged and rarely fleshy after flowering.

mucronàta, Gaudich. (*Árbutus mucronàtus,* Linn. f.). Much-branched shrub, to 2 ft., with glabrous or sparingly hairy branches: lvs. almost two-ranked, ovate, spiny-pointed, serrate, dark green and shining above, glabrous, ⅓–¾ in. long: fls. solitary, nodding, subglobose, white or slightly tinged pink, about one-fifth in. long: fr. white to dark purple, ⅓–½ in. across, red in the typical form. May, June. Magellan region to Chile. B.M. 3093. B.R. 20:1695. L.B.C. 19:1848. Gn. 23:389; 59, p. 41. Gt. 34, p. 214. G.M. 40:811. M.D.G. 1898:397. —Many vars. partly originated by hybridizing with the following species are cult. in English and Dutch nurseries, mostly differing in the color of the fr., which is usually indicated by the name of the var., as, var. **álba, atropurpùrea, coccínea** (F.M. 1879:339), **lilacina** (F.M. 1879:339), **nigra, purpùrea** (F.M. 1879:339), **ròsea, sanguinea.** Also *P. Drummondi, Cummingi, speciosa, floribunda* (G.C. II. 18:649 and III. 28:465), belong here. *P. mucronata* and its vars. are among our most ornamental fruiting shrubs in winter-time, when they are loaded with bright-colored berries contrasting well with the dark glossy foliage; they are also very handsome in spring when covered with their numerous white flowers.

angustifòlia, Lindl. (*P. mucronàta,* var. *angustifòlia,* Nichols.). Closely allied to the preceding: lvs. lanceolate to linear-lanceolate, usually arched backwards, smaller: fls. somewhat smaller, on slender pedicels; anthers twice as long as filaments; style as long as ovary. May, June. Chile. B.R. 26:63. B.M. 3889.

P. ciliàris Don. Spreading shrub: lvs. oblong to narrow-oblong, serrulate, ⅓-1 in. long: fls. solitary, ovate, white: fr. almost black. Mexico.—*P. ciliàris,* Lindl. G.C. II. 10:89, and III. 28:463, belongs probably to P. furens.—*P. fùrens,* Klotzsch. Upright shrub: lvs. ovate to ovate-lanceolate, ciliate, to 1½ in. long: fls. in axillary, secund, rather dense racemes: fr. brownish red. Peru, Chile. B.M. 4920.—*P. Péntlandii,* DC. Similar to P. mucronata, but lvs. not spiny-tipped: fr. dark purplish blue, with the calyx-lobes fleshy. Venez. to Chile. B.M. 6204.—*P. phillyreæfòlia,* DC. Similar to P. mucronata: branches sparingly hispid: corolla ovate, pubescent inside; anthers twice as long as filaments. Peru, Chile.—*P. pilòsa,* Don (Arbutus pilosa, Grah.). Prostrate shrub, with densely hispid branches: lvs. elliptic-oblong, serrate, to ¾ in. long: fls. ovate, white, solitary. Mexico. B.M. 3177. ALFRED REHDER.

PEROTTIA of a trade catalogue is an error for *Parrotia.*

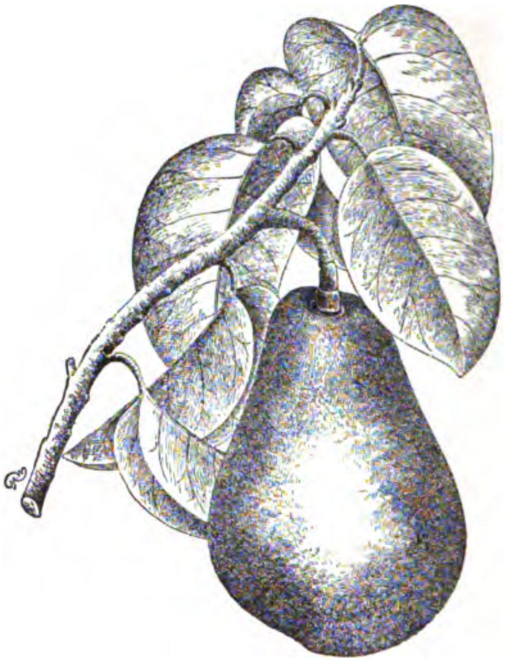
PERSÈA (pre-Linnæan name, ultimately derived from Persia). *Lauràceæ.* As understood by Bentham & Hooker, Persea contains about 100 species, but Meissner (DC. Prodr. 15, pt. 1, 43) distributes some of the species in other genera, and retains only 50 in Persea. The Perseas are trees or shrubs of the tropics or warm-temperate parts of America and the Old World, with thick alternate leaves and small white or greenish flowers, mostly in panicled fascicles; the flowers are usually perfect, with deeply 6-parted calyx, no corolla, and stamens usually 12 in 4 series, but one series sterile. The pistil is single, the ovary being sessile and tapering into a style which bears a disk-like stigma. Three species are in the American trade, all being prized for their clean evergreen foliage, and one of them, *P. gratissima,* for its large edible fruit. *P. Carolinensis* grows naturally as far north as North Carolina, and *P. Catesbyana,* a shrubby species which is not in the trade, grows naturally in south Florida.

A. *Outer calyx-lobes distinctly shorter than the inner.*

Carolinénsis, Nees. RED BAY. BULL BAY. Tree, reaching 40 ft., with smoothish branches: lvs. 2–3 in. long, oblong to lance-oblong, glabrous and deep green above, glaucous beneath: fls. pubescent, the peduncles of the clusters shorter than the petioles: fr. a small, blue drupe. Woods, N. Car. to Fla.—A handsome evergreen, with wood useful for cabinet work and other purposes.

AA. *Outer calyx-lobes equaling the inner, or very nearly so.*

Índica, Spreng. Handsome tree, with elliptic-oblong or lance-oblong attenuate-acute glabrous lvs. 3–8 in. long: panicle 3–6 in. long, the peduncles compressed, and the branches 3–5-fid., the fls. white and ¼ in. long: fr. scarcely fleshy. Canary, Madeira and the Azores Islands.—Offered by F. Franceschi, Santa Barbara.



1724. Alligator Pear. Persea gratissima (× ⅓).

gratissima, Gaertn. f. ALLIGATOR PEAR. AVOCADO PEAR. AQUACATE. MIDSHIPMAN'S BUTTER. Fig. 1724. Native to the American tropics, but now widely distributed: fls. greenish, downy, in dense fascicles which are arranged in leafless panicles: ovary downy, ripening into a large pear-shaped, green or purplish drupe, containing one large seed. B.M. 4580. B.R. 15:1258. I.H. 36:75.—Offered in southern Florida and southern California. The fruit is occasionally seen in northern markets. In Southern California and Mexico the fruit is common in the markets. It is grown to a small extent as far north as Los Angeles, but it requires a hotter climate to render the fruit certain and palatable. It will thrive in climates to which Anonas are adapted. L. H. B.

The Avocado, or Alligator Pear, is a native of the West Indies, Mexico to Peru and Brazil. It is very common in Jamaica, being found in every settlement or plantation. The tree grows to a height of 25 to 30 ft.; it has elliptical or elliptical-oblong leaves, 4–7 in. long, glabrate and pale beneath; the fruits are large, more or less pear-shaped, and covered with a green or deep purple skin, and containing a large quantity of a firm, yellowish green pulp, enclosing a single large seed. This fruit is highly esteemed by all classes in the West Indies. The pulp is marrow-like, and is eaten as a salad, usually with the addition of pepper, salt and vinegar. Europeans as a rule do not like the fruit at first, but once the taste is acquired they become exceedingly, often excessively, fond of it. The pulp contains an abundance of oil which may be used for illuminating purposes, also for soap-making. The seeds yield a deep, indelible black stain, and are used for marking linen. Plants are easily raised from seeds, and in good soil in warm situations they grow rapidly, and begin to fruit when about five years old. There are a good many varieties, differing from each other in size, shape and quality of fruit. These differences are not due to careful cultivation and selection in all cases, however, but to natural variation and accidental intercrossing. W. Harris.

PERSIAN INSECT POWDER. *Chrysanthemum*, p.312.

PÉRSICA. See *Prunus*.

PERSICÀRIA. Referred to *Polygonum*.

PERSIMMON. Plate XXVIII. Of the Persimmon, two types are known in cultivation for their fruit,—the native, and the Japanese or Kaki. The former is yet little improved, although it has possibilities. See *Diospyros*.

The native Persimmon or date plum, *Diospyros Virginiana* (Fig. 1725), is found growing wild in most of the southern states and as far north as 38° lat. It will thrive and ripen its fruit, however, as far north as the Great Lakes. The fruit is little known except to those who live in localities in which it grows wild, and even there but little attention has been given to its cultivation and improvement. The tree is usually of small size when grown in the open ground, reaching a height of 20–30 ft.; when grown in the forest it often reaches a height of 60–80 ft.: and in the rich alluvial river bottoms, from 2–3 ft. in diam. The wood is hard and elastic, and very durable when used for inside work, but it will rot very quickly when placed under ground. The fruit is subglobose and ranges in size from ½–2 in. in diam., depending largely on the number of seeds which it contains, although seedless varieties an inch in diameter are sometimes found. The fruit has a very disagreeable, astringent quality when green, but this disappears in most varieties when it becomes fully ripe. The date of ripening in the central states varies from Aug. 1 to Dec. 1. The old notion of early botanists that this fruit must be subjected to the action of frost before it becomes edible is erroneous; many of the very best varieties ripen long before the appearance of frost, while others never become edible, being so exceedingly astringent that neither sun nor frost has any appreciable effect on them. The Persimmon is readily propagated from seeds, which should be procured in the fall or early winter and planted in the same manner as peach pits; but as the seedlings, especially from cultivated varieties, cannot be relied upon to reproduce themselves, they should be budded or grafted when 2 or 3 years old. This should be done in the spring as soon as the bark will slip freely. This tree is more difficult to transplant successfully than almost any other kind of fruit. If too much of the long tap-root is cut off the tree will be sure to die. Transplant in the autumn, cut back most of the top, but preserve as much of the root as possible. The Persimmon will do fairly well on almost any kind of soil not too wet, but it will show its appreciation if planted on a rich, warm soil, well exposed to the sunlight, and kept well cultivated for the first few years after planting, until it becomes adapted to its new surroundings. J. Troop.

The Japanese Persimmon, Diospyros Kaki, is considered by the Japanese as their best native pomological product. Although cultivated in the south of France for more than 75 years, there is no record of its successful introduction into the United States previous to about 1870. Trees were first sent to California and subsequently to Augusta, Ga., but owing to defective roots and long delay in transit, the first and second shipments proved a failure, and not until 1876 came the first success with a few trees. All early importations of trees grown in Japan consisted of trees of small sizes with long tap-roots and no laterals; this, with imperfect packing, caused their loss and subsequent disappointment. American enterprise, however, remedied this, as nurseries were at once established near Yokohama and well-grown trees of the best varieties were exported to the United States. Experiments were made at the South by grafting upon native stocks. This proved successful when the graft was inserted upon the collar of the root, 3 to 4 inches below the surface of the soil; but top-grafting or budding upon side branches of large trees was seldom free from failure. The best method of propagating Japan Persimmons is by collar-grafting upon seedlings of the native species (*Diospyros Virginiana*), which are grown either by planting the seed in nursery rows or transplanting the young seedlings from seed-beds early in the spring. The seedlings can be budded during summer, and in favorable seasons a fair proportion of the buds will succeed.

The U. S. Department of Agriculture received a large quantity of trees from Japan about 1878 or 1879, and fearing that the winter of Washington might prove too cold the trees were sent to Norfolk, Va., where many bore fruit the following year. The first fruiting of which there is any record was at Augusta, Ga., in 1879, upon trees grafted upon native seedlings growing in the forest. As regards the hardiness of the Japanese Persimmons, an experience of twenty-five years demonstrates that some varieties are more resistant to excessive cold than others; but few can withstand a temperature of zero; and as a rule they are more successful below the 32d degree of latitude than farther north. Many seedlings have been produced that seem to have increased frost-resisting powers. Instances are reported in which some of these trees have withstood the winters of east Tennessee. By successive sowing of seeds from these hardier seedlings we may look for a race of trees, either of pure Japanese blood or crosses with our best native sorts, that will be adapted to the middle sections of the U. S., or as far north as is the habitat of the American species.

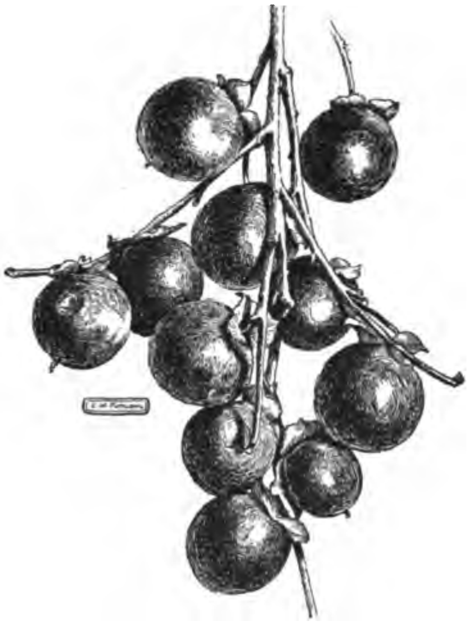
Seedlings, so far as proved by many experimenters, have a tendency to produce male flowers only during the first three years of blossoming. After that period a few female flowers appear in very small proportion, sometimes one female flower to 200 male flowers. Fully one-half of the seedlings produce nothing but male flowers; consequently the proportion of fertile trees is seldom more than 2 to 5 per cent at first blossoming, in cases in which subsequent female flowers appear not above 10 per cent. Again a large proportion of the fruit is small, austere and uneatable. This accounts for the small list of the really good sorts cultivated in Japan or exported here.

There is a great difference in the habit of growth and foliage of the varieties. All have broad and shiny leaves. Some varieties make a growth of 5–7 feet the first year from graft, and at 10 years form a tree 10 ft. in height. Others assume a dwarf, compact habit and seldom grow above 5–6 ft. in height; this class is more precocious in reaching the bearing age than the taller-growing sorts, which are also apt to overbear. It is not uncommon for a three-year-old tree to yield several hundred perfect fruits. Thinning the fruit as soon as set in early summer will prevent an early demise of the tree. Trees thrive in any soil in which the native species grow, but usually fail in wet soils.

The fruit of all the varieties is very attractive, both as to size and color. The latter is usually of a bright orange-red or vermilion, which is more or less intensified according to variety. The fruits begin to color when half grown, but should not be gathered until just before frost for the late-ripening varieties, or until soft with the early kinds. Some varieties begin to ripen in the middle South as early as September, but a part of the crop upon the same tree can be left to hang until frost and kept sound in a cool room until January. The round-shaped varieties ripen first, the oblong last and keep the longest; these latter should be slowly house-ripened to remove the slight astringency inherent to these varieties.

The flesh varies according to varieties, but is usually of a bright orange color, soft, rich and sweet and with an apricot flavor; when soft, the pulp should be eaten with a spoon. Some varieties have dark brown-red flesh, and are usually edible when quite solid. A peculiarity of these consists in both red or half red- and half brown-fleshed specimens being produced upon the same tree.

This is frequently the case when several varieties are grown near each other, possibly showing the effect of cross-pollination. This variation in the color of the flesh has caused some confusion in reaching a correct nomenclature. The earlier shipments of trees from Japan usually consisted of about 12 names, but no reliance could be placed upon these names. The same name was often found to apply to several distinct varieties, or one variety had several synonyms. After years of fruiting the so-called 40 varieties originally introduced, a more or less correct nomenclature has been attempted; but from the many local names found in various localities this has been a difficult task.



1725. The native Persimmon, Diospyros Virginiana (× ½).

In the annexed list of the most desirable varieties such synonyms are added thereto as have been ascertained after several years' trial. Many names refer to Japanese localities, others to their shape, size, color, etc.; their significance in Japanese has as far as possible been translated in English by Mr. Irata, a highly educated Japanese artist, to whom the writer is also indebted for valuable information as to the use of this fruit in his native country.

Among, or *Yemon* (name of a Japanese ornament).—Round, flattened, deeply ribbed, dark orange-red, and sometimes yellowish red, 2½–3 in. in diam.; average weight 6 ounces, and occasionally a specimen weighing 16 ounces is produced. Very sweet; flesh red and edible while still solid; quality improves as it becomes soft. Maturity Sept. to end of Nov. Tree of moderate height.

Hachiya ("Beehive" in Japanese).—Synonyms, Costata, Imperial, Yomato, etc. Oblong, with blunt apex, slightly ribbed, 2½ by 3 in.; average weight 5 ounces. Flesh deep orange-red, astringent while solid, but sweet and very good when soft. Should be house-ripened, and can be kept until March. Tree of vigorous and tall growth. This variety is usually dried in the manner of Smyrna figs and is of excellent quality; is often exported in the dried state.

Hiyakume or *Hyakume* (one hundred "me," a unit of Japanese weight). Plate XXVIII.—This is perhaps the most desirable of the round, red-fleshed varieties, and as the fruit affects various shapes, it is known under many names, such as Pound, Tane-nashi, or Seedless, etc. The Agricultural Bureau of Tokio gives the latter name to a variety with black mottled apex, but we find both round and elongated forms upon the same tree, as also uniformly orange and orange-yellow colored specimens, while many are heavily tipped with black. The variation of forms and colors doubtless led to its array of synonyms. Fruit large, averaging 3 inches in diam., and 5 ounces in weight; usually flattened, but elongated forms are quite common upon the same branch. Flesh bright orange-red. Keeps very late. Must be soft before being edible. Tree of moderate height; apt to be of dwarf growth. Sometimes seedless, but frequently with from 6 to 8 seeds.

Ioyama Gaki (name of locality).—Medium to large, round, but somewhat narrower at the apex, yellowish orange, with dark or black pencilings at apex. Flesh dark brown or grayish brown; very sweet. Can be eaten when solid; 4 to 6 ounces.

Kurokume (this may possibly be *Goshio-hira*, or Palace Persimmon).—Very large, round, somewhat flattened; 3 to 3½ in. in diam.; average weight 10 ounces, and sometimes yields specimens 16 ounces in weight; keeps late. Flesh red. Tree erect grower.

Minokaki (Persimmon from Mino, name of a locality).—Synonym, Large Stork Egg. Large to very large, oblong, pointed, frequently weighing 10 to 12 ounces; skin bright vermilion-red; flesh red, rich but astringent unless softened by house-ripening. The foliage is very long, narrow and distinct from any other variety. Immensely productive, a 6-year-old tree having produced upwards of 500 specimens. Usually prepared in Japan for winter use by being placed in a closed barrel until the astringency is removed. Also valuable for drying.

Miyo-tan (Mazelli).—Plate XXVIII. Round or slightly oblong, 2½ in. diam.; average weight, 5½ ounces; slightly ribbed; deep orange-red; flesh usually deep brown-red, but bright red- or half red- and half brown-fleshed specimens are often produced upon the same tree, the results of cross-fertilization by other varieties. Tree of medium or dwarf growth; exceedingly prolific. Fruit keeps very late. The brown-fleshed specimens are edible while solid, and as early as October 1.

Okame ("Stout young girl" in Japanese).—Synonyms, Oblong Hyakume, Mikado, etc. Medium to large, 2½ x 3½ in., oblong, deep red, nearly always seedless; keeps late.

Tsuru-no-ko ("Stork Egg").—Plate XXVIII. Large, oblong, pointed, 2½ x 3½ in.; weight 4–5 ounces, sometimes 10 ounces; skin bright red; some specimens covered with black at apex; flesh red, very good. Keeps late; edible only when soft. Foliage long and shiny; tree compact and vigorous grower. This variety varies very much as to size at different seasons.

Yedo-Ichi (also written "Yeddo-Ichi No. 1," or "best in Yedo," latter being the old name of Tokio).—Syn., Maru-Gata ("round shape"). Medium, round, some specimens slightly oblong, flattened at base and narrowing at apex; skin dark red, often with black mottlings near apex; flesh mahogany brown, with darker spots, brittle, and is edible while solid as early as Oct. 1. Very prolific, and bears fruit in large clusters. Tree an upright grower.

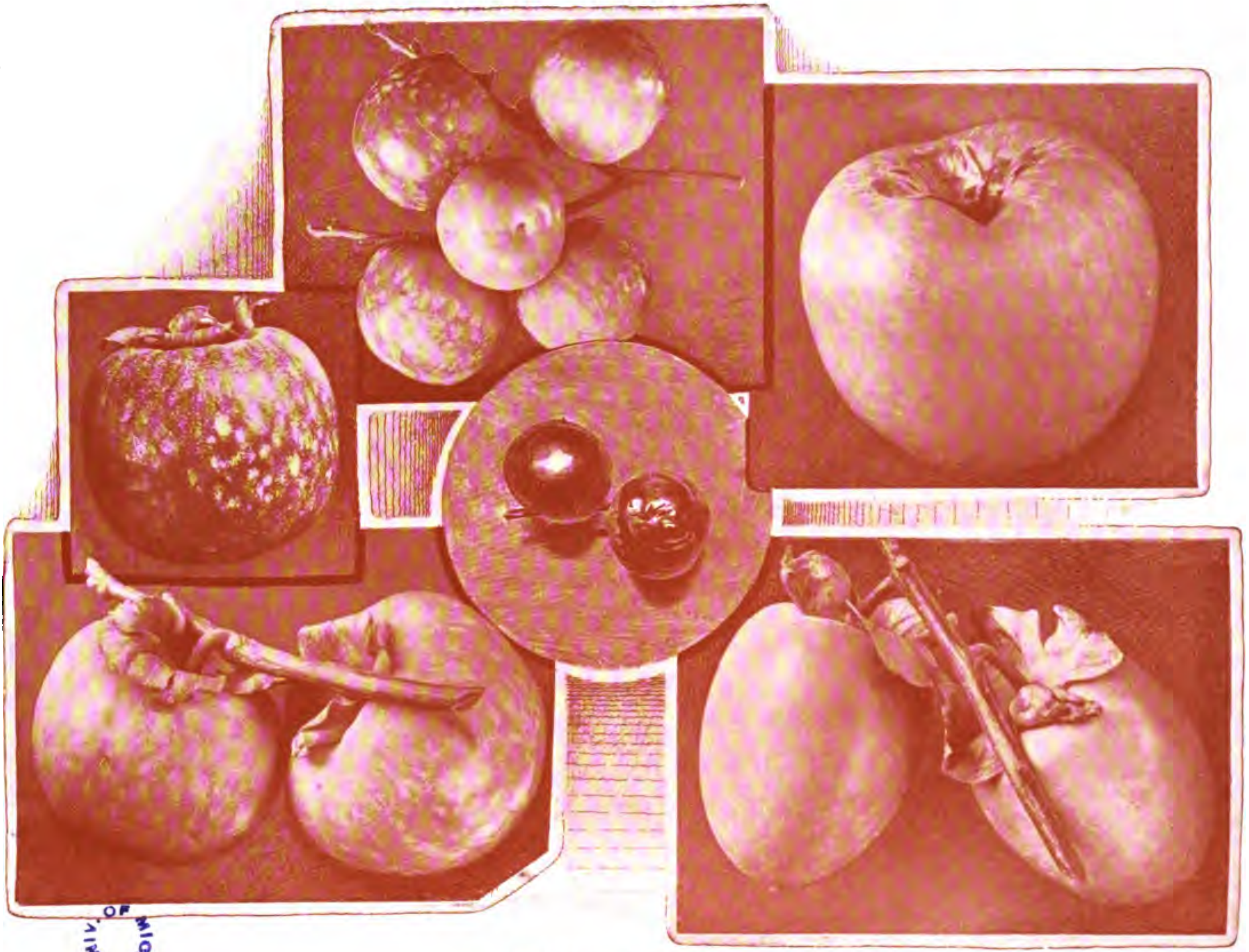
Zengi, or *Zingi* (name of Japanese village).—Plate XXVIII. Small, 1¾ x 2 in.; weight 3 to 4 ounces; flesh dark brown, with darker spots; very sweet; edible as early as middle of September while still solid, and lasts throughout October.

P. J. BERCKMANS.

Another Estimate of the Japanese Persimmons.—Grafted on our native Persimmon, *Diospyros Virginiana*, the Japanese varieties seem perfectly at home and make much longer-lived trees than those imported from Japan. All varieties come into early bearing and many of them are too prolific for the best welfare of the trees. This tendency to overbear should be corrected by thinning the fruit. Several of the varieties produce very large fruit, single specimens often weighing over a pound.

Some of the varieties ripen in August, some in November, and others intermediate between these dates. It requires some experience to determine just when the fruit has reached the proper stage to be marketed, and this varies with the different varieties. Some of the varieties have dark flesh, others light flesh, still others a mixture of the two. The light and dark flesh differ radically in texture and consistency, as well as appearance, and when found in the same fruit are never blended, but always distinct. The dark flesh is never astringent; the light flesh is astringent until it softens. The dark-fleshed fruit is crisp and meaty, like an apple, and is edible before it matures. Some of the entirely dark-fleshed kinds improve as they soften. The light-fleshed kinds, and those with mixed light and dark flesh, are very delicious when they reach the custard-like consistency of full ripeness. In some, the astringency disappears as the fruit begins to soften; in others it persists until the fruit is fully ripe. Seeds accompany the dark flesh. The light-fleshed kinds are seedless. The kinds with mixed flesh have seeds in proportion to the quantity of dark flesh.

The market value of the fruit is at present more or less erratic. A large proportion of the fruit-eating people of the North do not yet know what a fine fruit the Japanese Persimmon is. The fruits have to be shipped while hard and allowed to ripen after reaching destination. Commission men are likely to sell them and the public to eat them—or attempt to do so—a week or two ahead of the proper stage of ripeness; hence the



UNIV. OF MICH.

Plate XXVIII. Persimmons.

Center, native Persimmon, ***Diospyros Virginiana***. The others are the Kaki or Japanese Persimmon: top, Zengi; left, Miyo-tan; lower left-hand corner, Hiyakume; lower right, Tsuro-no-ko; upper right, Tane-nashi. All one-half natural size.

Japan Persimmon in its best condition is comparatively little known.

The following are some of the most prominent varieties (as understood by the writer) arranged in order of ripening, beginning with the earliest; although it must be borne in mind that some of the varieties are more or less interchangeable, in different seasons.

Zengi.—The smallest of all; round or roundish oblate; diameter 1¾ in. longitudinally and 2¼ in. transversely; skin yellowish red; flesh very dark, quality good; seedy; edible when still hard; one of the earliest to ripen. Vigorous, prolific.

Taber No. 129.—Medium, roundish, flattened at base; has a small but well-defined point at the apex; diam. about 2⅛ in. both ways; skin dark yellow-red, with peculiar roughened surface, somewhat resembling alligator leather in appearance and markings, except that the marks are usually very small and uniform; flesh light brown, crisp, sweet, meaty, free from astringency; excellent; a good keeper and shipper.

Yeddo-Ichi.—Large, oblate; diameter 2½ in. longitudinally and 3 in. transversely; very smooth and regular in outline, with dinted appearing surface and slight depression at end opposite the stem; skin darker red than most varieties, with heavy bloom; flesh very dark brown, verging toward purplish; sweet, rich, crisp; in quality one of the best. The fruit is good to eat when still hard. A heavy bearer and exceedingly thrifty.

Hyakume.—Large to very large, varying from roundish oblong to roundish oblate, but always somewhat flattened at both ends; generally slightly depressed at the point opposite the stem; diameter 2¼ in. longitudinally and 3⅛ in. transversely; skin light buffish yellow, nearly always marked with rings and veins at the apex; flesh dark brown, sweet, crisp and meaty, not astringent; good while still hard; a good keeper; one of the best market sorts. Of good growth and a free bearer.

Yemon.—Large, flat, tomato-shaped, somewhat four-sided; diam. 2¼ in. longitudinally and 3¼ in. transversely; skin light yellow, changing to dull red, mottled with orange-yellow; distinct in color; flesh deep, dull red, brown around the seeds, of which there are usually a few; some specimens are entirely light-fleshed and seedless; there is no astringency after the fruit begins to soften; quality fine; one of the best. In form some of the fruits have the corrugations converging to the depressed apex, as it is usually figured, but most do not.

Hachiya.—Very large, oblong, conical, with short point; very showy; diameter 3¾ in. longitudinally and 3¼ in. transversely; skin dark, bright red, with occasional dark spots or blotches and rings at the apex; flesh deep yellow, sometimes having occasional dark streaks, with seed. Astringent until ripe, then very fine. The largest and handsomest of all. Tree vigorous and shapely; bears fairly well, but is not as prolific as some of the other varieties.

Taber No. 23.—Medium, oblate, flat or depressed point; diam. 1⅛ in. longitudinally and 2⅝ in. transversely; skin rather dark red, with peculiar stipple marks; flesh dark brown, sweet and not astringent; seedy; good. Prolific.

Tane-Nashi.—Large to very large, roundish conical, pointed, very smooth and symmetrical; diam. 3¼ in. longitudinally and 3⅛ in. transversely; skin light yellow, changing to bright red at full maturity; flesh yellow and seedless; quality very fine; perhaps the most highly esteemed of the light-fleshed kinds. Tree is vigorous and bears well.

Okame.—Large, roundish oblate, with well-defined quarter marks, point not depressed; diameter 2⅝ in. longitudinally and 3⅛ in. transversely; skin orange-yellow, changing to brilliant carmine, with delicate bloom and waxy, translucent appearance; the most beautiful of all; light, clear flesh when ripe, with light brown center around the seeds, of which it has several; loses its astringency as soon as it begins to ripen; quality fine. Tree vigorous and good bearer.

Triumph.—Medium; tomato-shaped; skin yellow; flesh yellow; generally has a few seeds; very productive; quality of the best. Ripens from Sept. till Nov.

Tsuru.—Large, slender, pointed; longest in proportion to its size of all; diam. 3⅛ in. longitudinally and 2⅝ in. transversely; skin bright red; flesh orange-yellow, some dark flesh around the very few seeds; astringent until fully ripe, then good.

Costata.—Medium size, conical, pointed, somewhat four-sided; diam. 2⅛ in. longitudinally and 2⅝ in. transversely; skin salmon-yellow; flesh light yellow, dark flesh and seeds occurring seldom; astringent until ripe, then very fine; a good keeper. Tree distinct; a rapid, upright grower; foliage luxuriant; the most ornamental of all the varieties mentioned.

G. L. Taber.

PERU, MARVEL OF. *Mirabilis Jalapa.*

PERUVIAN BARK. *Cinchona.*

PESCATÒRIA (after M. Pescatore, who had a large collection of orchids at St. Cloud, near Paris). *Orchidàceæ.* A group often united with Zygopetalum, but in horticultural works usually treated as a distinct genus. The lvs. are equitant, tufted, without pseudobulbs: fls. solitary on stems 3–6 in. long, from the axils of the lvs., mostly large and showy, and fragrant; sepals and petals broad, concave, spreading; the lateral sepals forming a mentum; labellum clawed, lateral lobes small, middle lobe rounded, spreading; crest thick, consisting of a number of keels arranged in a semi-circle near the base of the lip; column slender, not boat-shaped. About 10 species. For culture, see *Zygopetalum.*

Klabochòrum, Reichb. f. Lvs. strap-shaped, 1 ft. or more long: fls. 3–3½ in. across, variable in color; sepals oblong, obtuse; petals shorter, all white with chocolate-purple points; labellum 3-lobed, yellowish or white, and having many purple-tipped hairs; callus sulfur-colored, with brown keels. Ecuador. Gn. 22:344.

Dayàna, Reichb. f. Lvs. tufted, 6–10 in. long: fls. on short scapes; sepals oblong-obovate, acute, white, with green tips; petals rhomboid-rotund; labellum clawed, angled on each side of the base; limb oblong, emarginate, revolute on the sides, white with a callous ring which is purple-violet, the base being of the same color; column yellow, with a red band near the base and the anther of the same color. Late autumn. Colombia. Var. **rhodàcra,** Reichb. f. Sepals and petals with rose tips; labellum orbicular, suffused crimson. B.M. 6214.

cerina, Reichb. f. Lvs. in tufts of 4 or 5, cuneate-oblong, pointed, 1 ft. long: peduncles 2–6 in. long, 1-fld.: sepals and petals nearly equal, the latter somewhat clawed, fleshy, rounded, concave, pale straw color; labellum ovate, yellow, with a thick semicircular crest. Flowers at various seasons, the fls. lasting a long time. Chiriqui. B.M. 5598 (as *Huntleya cerina*). F.S. 17:1815 (as *Zygopetalum cerinum*).

Heinrich Hasselbring.

PETALOSTÈMON (named from the peculiar relation of the petals and stamens). *Leguminòsæ.* About 22 species of American herbs, mostly western and perennial, glandular-dotted, with small odd-pinnate lfts. and spikes which are terminal or opposite the lvs. and bear many small fls. ranging from white through rose to purple and violet. *P. violaceus* is a charming plant, thriving in any light soil and forming a broad, low bush with finely cut foliage, and bearing a constant succession of showy spikes of deep violet flowers. Well adapted for the front of the border or the rockwork.

Petalostemon and Dalea are characterized by having the lower petals longer than the standard, with their claws adnate to the staminal tube; but Petalostemon has only 5 stamens, while Dalea has 9–10. Other generic characters: calyx-teeth or lobes about equal: standard cordate or oblong, with a free, slender claw, the 4 lower petals distinct and subsimilar: ovary sessile, 2-ovuled: pod included by the calyx, membranous, usually indehiscent and 1-seeded.

A. *Fls. white.*

cándidus, Michx. White Prairie Clover. Height 1–2 ft.: lfts. 5–9, oblong or oblanceolate, 8–12 lines long. Ind. to N. W. Terr., south to La. and Tex. B.B. 2:289.

AA. *Fls. rosy purple or violet.*

B. *Habit decumbent.*

decúmbens, Nutt. Stem about 1 ft. long: lfts. 7–9, linear-oblong: fls. deep violet-purple. Red River, Ark.

BB. *Habit erect.*

C. *Bracts glabrous.*

violàceus, Michx. Violet Prairie Clover. Height 1½–3 ft.: lfts. 3–5, narrowly linear, often mucronate at apex: fls. violet or purple; corolla about 2 lines long. Prairies, Ind. to Texas. B.B. 2:290. B.M. 1707.

CC. *Bracts silky-pubescent.*

tenuifòlius, Gray. Silky Prairie Clover. Height 1–2 ft.: lfts. 3–5, linear, obtuse at apex: fls. rose-purple. Dry soil, Kans. to New Mex. B.B. 2:291.

J. W. Manning and W. M.

PETASÌTES (Greek, *a broad-brimmed hat;* referring to the large, broad lvs.). *Compósitæ.* About 8–12 species of hardy perennial herbs much like the common coltsfoot (*Tussilago Farfara*), having large lvs. of the same general shape and more or less covered with the same white felt, but the fls. range from purple to white, not yellow, and are borne in corymbs instead of singly. They are rather coarse and weedy, but the following are desirable for special purposes.

P. fragrans, the Winter Heliotrope or Sweet Coltsfoot, has the merit of blooming in winter and its fls. have a delightful vanilla-like odor. The fls. are small and vary from pale lilac to purple. A few sprays are desirable for cutting during winter. The plant also differs from the common coltsfoot in having darker colored and evergreen foliage. It is suitable for carpeting shrubberies and for dry banks of stiff clay where choicer subjects will not thrive. Like most others of the genus, it spreads rapidly by underground runners. This plant seems to be unknown to American commerce; the above points being taken from Gn. 23, p. 113, and 53, p. 328, where the plant is well pictured.

P. palmata blooms from April to June, its fls. varying from nearly white to pale blue or purplish. It is found in rich dark swamps or sphagnum bogs from Newfoundland to Alaska and south to N. Y., Wis. and Calif. It has been offered by two dealers in native plants.

P. Japonica, var. *gigantea* has recently appeared in European and American garden literature. The catalogue of the Yokohama Nursery Company states that the leaf-stalks grow 6 ft. high and 1–1⅛ in. thick. The stalks are eaten as a vegetable after being boiled, and are also preserved in salt or sugar. The flower-buds, which appear in February, are used as a condiment, as they have a slightly bitter but agreeable flavor. The plant has been advertised in America since 1900 by several dealers.

The genus is widely distributed in north temperate and subarctic regions. The number of species is uncertain, but the essential character of the genus (as distinguished from Tussilago) is that the heads are nearly or quite diœcious, and rayless or with very short and not showy rays; also the fact that the scapes usually have many fls. instead of one. The lvs. are orbicular or reniform, always with a deep heart-shaped base and the scapes are covered with scales like a coltsfoot but sometimes the lower ones are more leafy.

A. *Size of lvs. gigantic, 3½–4 ft. across.*

Japónica, F. W. Schmidt. Island of Sachaline. Var. **gigantèa**, Hort. Lvs. orbicular, margin wavy. Sachaline Isl.—Grows as high as a man.

AA. *Size of lvs. 3–12 in.*

B. *Blooming December to March.*

fràgrans, Presl. WINTER HELIOTROPE. SWEET COLTSFOOT. Height 8 in.: lvs. appearing during or after anthesis, orbicular, margined with small cartilaginous teeth, glabrous above, pubescent and green below: heads fragrant, the marginal fls. of the female heads in the form of short rays. Mediterranean region.

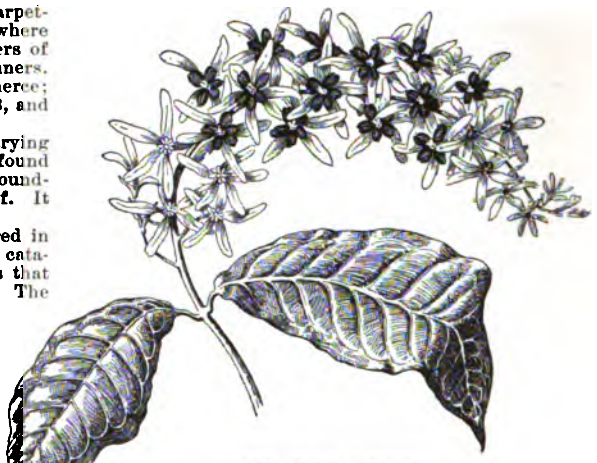
BB. *Blooming April to June.*

palmàta, Gray. Height 6–24 in.: lvs. orbicular in outline, deeply 7–11-cleft beyond the middle, and the lobes sharply dentate, green and glabrous above, densely white-tomentose beneath: heads fragrant, 4–6 lines across, the marginal fls. of the female heads in the form of short rays. E. Asia, N. Amer. B.B. 3:469.

W. M.

PETRÈA (Robert James, Lord Petré, 1710–1742, a patron of botany who had the finest collection of exotic plants in Europe). *Verbenàceæ. Petrea volubilis*, or the Purple Wreath, is one of the rarest, most distinct and beautiful of tender climbers. The flower is like a 5-pointed star of lilac with a good-sized violet in the middle. See Fig. 1726, which indicates the graceful raceme 7–8 in. long, containing perhaps two dozen flowers. The flowers begin to open at the base of the raceme and the showy 5-pointed star is the calyx, whose sepals are colored like petals. The calyx spreads open while the corolla is still a round bud in the middle, and it remains after the corolla has fallen, so that the vine, at first glance, seems to bear two kinds of flowers. The blooms appear in March and April. It should be in every greenhouse collection, although it is of very irregular growth. It does not bloom freely in small plants; it probably has other drawbacks, for it has always been a rare plant in Europe, though often enthusiastically commended. The fls. seem to vary considerably in color: The Purple Wreath is suitable for rafters. Propagated by cuttings of dormant wood taken just before the new growth begins. Give the cuttings bottom heat.

Petrea is a genus of about 16 species of tropical American twining or arborescent shrubs: lvs. opposite, leathery: fls. violet, purple or bluish in long, terminal racemes; calyx-lobes colored during anthesis but often becoming green in fr.; corolla usually a little more intensely colored; limb 5-cut, oblique; stamens 4, didynamous: ovary imperfectly 2-loculed; locules 1-ovuled.



1726. Petrea volubilis.

From a cluster 7 or 8 in. long.

volùbilis, Linn. PURPLE WREATH. Fig. 1726. Lvs. 3–4 in. long, short-stalked, ovate, elliptic or oblong, acuminate or obtuse, entire or wavy. Cuba to Brazil. B.M. 826. F.C. 3:108. Gn. 12:82.

G. W. OLIVER and W. M.

PE-TSAI or Chinese Cabbage. *Brassica Pe-Tsai.*

PETTÈRIA (after Franz Petter, a Dalmatian botanist; died 1853). *Leguminòsæ.* Only one species, very similar in habit to Laburnum, but with the yellow fls. in upright dense racemes, terminal on leafy branchlets. It is but rarely cultivated, since it is less showy in bloom than Laburnum or many species of Cytisus. It is probably hardy as far north as Mass., and requires the same culture as Laburnum, which see. If grafted, Laburnum is to be used as a stock. This monotypic genus is closely allied to Laburnum, but differs by its upright racemes, by the wings and keel being at the base adnate to the stamens and by the sessile ovary. It is said to possess the same poisonous properties as that genus.

ramentàcea, Presl. (*Cýtisus fràgrans*, Weld. *C. Wéldeni*, Vis. *Labúrnum ramentàceum*, C. Koch). Upright shrub, to 6 ft.: lvs. 3-foliolate, almost glabrous or sparingly pubescent when young, on about 1 in. long stalks; lfts. cuneate, obovate to oblong, usually obtuse, ¾–2 in. long: fls. fragrant, very short-pedicelled, in 1–3-in. long, dense racemes; calyx 3-lobed, silky; keel silky: pod linear-oblong, sparingly silky, to 1⅛ in. long. May, June. Dalmatia, Istria. B.R. 29:40.

ALFRED REHDER.

PETTIGREE, Pettigrue, or Butcher's Broom. *Ruscus aculeatus.*

PETÙNIA (South American aboriginal name, said to have been applied to tobacco). *Solanàceæ.* There are twelve or more species of Petunia, mostly native of the southern part of South America. One or two grow in Mexico and another (*P. parviflora*) is naturalized in the southern parts of the U. S. Petunias are small herbs of straggling or decumbent habit, pubescent and usually viscid, with opposite entire lvs. and large showy axillary flowers. The genus is closely allied to Salpiglossis, being distinguished by having 5 perfect stamens, whereas that genus has 4. The calyx is 5-parted, and, in the cultivated species, several times shorter than the corolla, which is long-salverform or somewhat funnelform and indistinctly 5-lobed. The colors are white to light purple, not blue, clear red nor yellow.

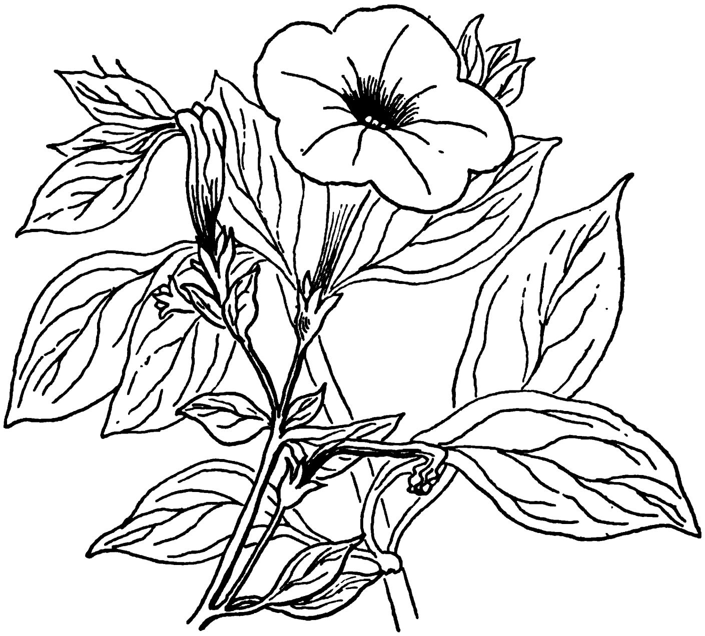
Petunias are of the easiest culture. They demand a warm, open, sunny place. Seeds may be sown directly in the open, or the plants may be started in flats or pots indoors for early results. The plants are tender and therefore should not be trusted in the open until settled weather comes. Thin the plants to 12–18 in. apart. They bloom when very small, and continue to blossom as they grow until destroyed by frost. The common Petunias are rather weedy in habit, but their great profuseness of bloom under all conditions makes them useful and popular. They are particularly useful for massing against shrubbery, for they make a florid undergrowth with almost no care. Some of the modern improved named varieties are very choice plants, and one would scarcely believe, if he were ignorant of the genus, that they represent the same species as the flowers of 25 years ago. These high-bred types require more care in the growing. They would best be started indoors, and be given the choicest positions in the open garden. Petunias are tractable as winter subjects under glass. The best procedure is to sow seeds in late summer or early fall and to grow stocky plants in pots; but old plants can be lifted on the approach of cold weather, cut back, and taken inside for winter bloom. They require cool treatment, a night temperature of 45° to 50° seeming to suit them well.

nyctaginiflòra, Juss. Fig. 1727. Tall and relatively stout, usually growing erect: lvs. large and rather thick, oval-oblong, upper ones nearly or quite sessile and the lower ones narrowed into a distinct petiole: fls. dull white, long-tubed (the tube three or four times the length of the calyx), fragrant at evening. Argentina. B.M. 2552.—Occasionally seen in old gardens.

violàcea, Lindl. Stems slender: lvs. oval or ovate, sessile or very short-stalked: fls. smaller, broad-tubed (the tube twice or less the length of the linear calyx-lobes), rose-red or violet, the limb relatively short. Argentina. B.R. 19:1626. B.M. 3113 (as *Salpiglossis integrifolia*).—Not now in cult. in its pure form.

hýbrida, Hort. Figs. 1728–30. The common Petunia, a hybrid derivative of the two preceding. For history, see Bailey, "Survival of the Unlike," Essay 29. P.M. 2:173 (as *P. nyctaginiflora violacea*). B.M. 3556.—This type is wonderfully variable, but it differs markedly from either stem parent: from *P. nyctaginiflora* in its broader tube and many colors; from *P. violacea* in its longer tube, wider limb, and many colors; from both in its much larger and multiform flowers and more stocky growth. In some of the strains, the flower is very broad and open, measuring 4 or 5 in. across. There are types with the flowers deeply fringed; others with star-like markings radiating from the throat and extending nearly or quite to the margin of the limb; others with full double flowers. The colors range from white to deep red-purple, and variously striped and barred. There are forms of very dwarf and compact habit. Only a small proportion of the seedlings of the double strains bear double flowers; but the single flowers are usually of superior size or color. The reason for this small percentage of doubles is the fact that the seed must be selected from single flowers, because the full double ones do not produce seeds. Single flowers carefully pollinated with pollen from double flowers will give seed that will produce an average of 25 per cent doubles, and single flowers bearing petaloid anthers will give an average of 40 per cent doubles. Usually the weaker seedlings, in any batch of a double strain, are most likely to produce double flowers. Fancy varieties may be propagated by cuttings from plants that are carried over winter, although cuttings of double forms do not always come true. L. H. B.

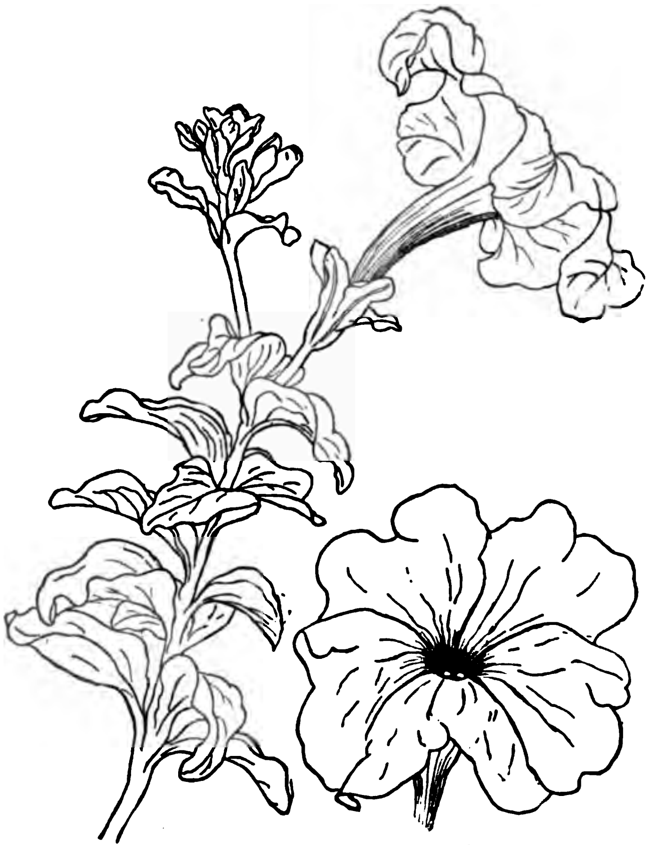
Petunias in California.—The Petunia is one of the most variable of all flowers and shows a very strong tendency to revert to the natural type. The plant-breeder cherishes not one, but many, ideals. It is the perfect habit of a certain plant that one wishes to combine with the flowers of another. Or the object is to give to this flower a little heavier texture; to another an added frill upon this blossom; a richer color there, a greater depth to this throat, a more distinct ring here, an absolutely pure tone of color in another, to intensify the rainbow tints in another, to deepen the color of those blotches while retaining the pure white background. In an ideal Petunia the first requisite is color, while form, size, texture, marking and habit are all of nearly equal value.



1727. Petunia nyctaginiflora (X ½).

The California Giant Petunias originated with the undersigned at Ventura, Calif., in 1888, and in their present condition are the result of very careful study through a long series of continuous cross-fertilizations. They are grown in the open ground, and usually transplanted directly from the seed boxes. We have new seedling stock each year, but retain plants the second year for seeding purposes. The strain comprises 19 varieties, including the Ruffled Giants seen in Fig. 1730. The blossoms are all hand-pollinated and in the case of the New Fancy Fringed Perfection Double each seed-pod is handled from 7–12 times.

To those persons who are willing to take the most pains to raise the best Petunias, the undersigned would say that the germination of each seed is of utmost importance, for every seed represents an individual plant. No two Petunia plants give blossoms of the same kind, and there are invariably points of excellence and difference in all. In a packet of seed containing say 200 seeds, the purchaser may feel satisfied if he bring 20 plants to the blooming stage, and may think he has exhausted the possibilities of the strains, whereas the Petunia specialist would know that in those 180 seeds which did not come to the blooming stage a wealth of beauty had escaped him. Then the writer emphatically urges all to care for each seed. Fill shallow boxes with fine, light soil, say an even mixture of leaf-mold and sand, and wet thoroughly by pouring on boiling water —to prevent trouble from insects and to heat the soil. When the soil has cooled sufficiently but is still warm, sow the seeds very thinly in the boxes, so that the plants may be 1 in. apart. Cover seeds very slightly with a little sifted sand, and place a piece of slate or glass on top of the boxes. If the white root points of germination appear before the leaves, sift on more sand, and watch closely. When the small leaves appear, remove slats and give plenty of light, to produce strong, stocky plants. The soil may now need water, which should be applied very gently, that the tiny seedlings may not be displaced. Later the larger plants may be transplanted from seed-boxes into other boxes or pots. As the weakest plants frequently give the finest blossoms, care should be taken to preserve every plant until the blossoms appear.



1728. Petunia hybrida (× ½).
Form with short conduplicate foliage.

Mrs. Thos. Gould.

PEUCÉDANUM (ancient Greek name). *Umbelliferæ.* There are many views as to the limits of the genus Peucedanum, which is equivalent to saying that it has no limits. Bentham & Hooker made it a most complex group, comprising about 100 Old World and New World species, and including such genera as Petroselinum, Anethum, Imperatoria, Tommasinia, Pastinaca, Tiedmannia, Lomatium. Coulter & Rose, the latest American monographers (Monogr. of the N. A. Umbell., U. S. Dept. Agric. 1900), remove the American species and accept Rafinesque's genus Lomatium. With this view we agree, and the cult. species are referred to this genus in the following account. For *Tommasinia verticillaris*, of southern Europe, offered by American seedsmen, see *Tommasinia*. For *P. graveolens*, which we prefer to call *Anethum graveolens*, see *Dill*.

Lomatiums are all western American plants, of about 60 species, growing in dry soil. They are stemless (or nearly so) perennial herbs from tuberous or fusiform roots, and compound (ternate, pinnate or dissected) leaves. From Peucedanum the genus differs, according to Coulter & Rose, as follows: "Peucedanum consists of tall and branching mesophytic plants of low fertile meadows of the Old World, with several umbels, conical stylopodium, and solitary oil tubes; while Lomatium consists of low xerophytic plants of acaulescent habit belonging to the arid regions of western North America, with usually single umbels terminating simple elongated peduncles, no stylopodium, and often several oil tubes." Horticulturally, the Lomatiums are of small value, and they have not been cultivated sufficiently to have given rise to cultural forms. A few of the species have been offered by dealers in native plants. They seem to thrive well in dry, exposed places. They are interesting for the front row of hardy borders and for colonizing in wild open places, and for use in rockwork.

A. *Peduncles usually slender, never swollen at the top.*

B. *Bractlets of involucel conspicuous, often broad or united at base.*

L. dasycárpum, Coult. & Rose (*Peucédanum dasycárpum*, Torr. & Gray). Stem very short or wanting: peduncles several, stout, pubescent, 2 in. or less high: lvs. rather small, pinnately decompound, the numerous segments short-linear: umbel 6–15-rayed, bearing white fls.: fr. nearly orbicular. Southern Calif.

BB. *Bractlets small or wanting.*

C. *Lvs. narrow in outline, pinnate.*

L. Hállii, Coult. & Rose (*P. Hállii*, Wats.). Very short-stemmed, the peduncles 6–16 in. tall and glabrous: lvs. oblong in outline, the segments ovate and deep-toothed or pinnatifid: umbel 3–6-rayed, bearing yellow fls.: fr. broadly elliptical, glabrous. Ore. and Wash.

C. *Lvs. broad in outline, 1–3-ternate.*

L. platycárpum, Coult. & Rose (*P. simplex*, Nutt.). Often tall and stout, but sometimes nearly stemless: lvs. ternate or 2-ternate, the lfts. almost filiform to linear-lanceolate: umbel 3–15-rayed, bearing yellow fls.: fr. broadly oblong to nearly orbicular, sometimes emarginate at each end. Colo. and Utah to Mont. and Wash.

L. triternàtum, Coult. & Rose (*P. triternàtum*, Nutt.). Sometimes 2–2½ ft. high: lvs. 2–3-ternate, the lfts. narrow-linear to linear-lanceolate: fls. deep yellow: fr. narrowly oblong, glabrous. N. Calif. to B. C.

AA. *Peduncle stout, swollen at the top.*

L. nudicaùle, Coult. & Rose (*P. nudicaùle* and *P. leiocárpum*, Nutt.). Stemless, glabrous: peduncle 12–16 in. tall, from a long, fleshy root: lvs. 1–2-ternate or 3-quinate, the lfts. thickish and ovate to narrow-lanceolate: umbel unequally 5–20-rayed, bearing yellow fls.: fr. narrowly oblong. Calif. north and west.

L. H. B.

PEÙMUS (said to be a Chilean name). Syn., *Boldòa*, *Boldea*. *Monimiàceæ.* A genus of one species, the Chilean Boldo, a small tree of considerable economic interest. It has exceedingly hard wood, which is used for making many kinds of implements; it also makes a charcoal said to be prized by smiths above all others. The bark is used in tanning and dyeing. The lvs. are used in medicine. The fruits are edible; they are small berries, sweet and aromatic. Finally it has some ornamental value, being evergreen and fragrant throughout. The fls., which are not very showy, are white, ½ in. across, and borne in small panicles, each branch of which is parted into three. This tree has been advertised in southern California. The male tree has been cult. under glass in Europe, but scarcely outside of botanic gardens and only for its economic interest.

Generic characters: male fls. with 10–12 perianth-lobes, overlapping in 2–3 series, the outer ones herbaceous or membranous, the inner ones more petal-like; disk investing the calyx-tube pilose within; stamens numerous: female fls. smaller, the lobes more inequal, after anthesis circumscissile above the disk-bearing base and deciduous: drupes 2–5: seeds pendulous; albumen copious.

Bóldus, Molina (*Boldòa frágrans*, C. Gay). Attaining 20 ft.: lvs. opposite, leathery, very rough and warty. Chile. B.R. 31:57.

PFÁFFIA (C. H. Pfaff, 1774–1852, German chemist). *Amarantàceæ.* Nine species of slender perennial herbs from Brazil, tomentose or villous, rarely glabrate: lvs. opposite, sessile or nearly so, entire: heads or spikes densely-fld.: bracts and bractlets transparent: fls. usually in solitary, long-peduncled heads, bracteate and with 2 bractlets; perianth 5-parted; staminal tube long, 5-cut to the middle, the anther-bearing teeth ciliate at the margin: stigma discoid or head-like, entire or 2-lobed.

Pfaffia gnaphalioides (syn., *Gomphrena gnaphalioides*) has been slightly known to European gardens for a good many years. In 1899, Peter Henderson & Co. offered "*Gomphrena gnaphalioides*, or the Trailing Amaranth," with the remark that it is a desirable trailer for covering embankments and rocks, thrives on poor, dry soil and has white fls. like small clover blossoms. Because of the failure of the seed crop, however, the plant did not become established in the American trade. The probability is that the plant in the trade at present as *Gomphrena gnaphalioides* is incorrectly named. In catalogues the trade plant is figured with the flower-heads in clusters of three and on short stalks, while DeCandolle describes the heads as solitary and long-stalked. Moreover, the true plant has always been regarded as a stove plant in Europe, and at best it could be treated in America only as a tender annual and not as a hardy and permanent subject.

gnaphalioìdes, Mart. (*Gomphrèna gnaphalioìdes*, Vahl). Stems subshrubby below: lvs. lanceolate, 10–15 lines long, 2–4 lines wide, soft, ashy gray above, woolly beneath: peduncles 5–7 in. long: heads globose, 6–9 lines across: bracts unequal, ovate, mucronate, scarious, the lower one villous, lateral ones longer, glabrous at the base; stigma globose. W. M.

PFEÌFFERA. See *Rhipsalis*.

1729. Petunia hybrida (× ⅛).
A double form.

PHACÈLIA (Greek, *cluster;* on account of the crowded flower-clusters of the first described species). *Hydrophyllàceæ.* Annual and perennial plants of the western hemisphere, chiefly North American. The genus includes the old genera Whitlavia, Eutoca, Microgenetes, Cosmanthus, and several others. About 50 species exist in North America, the region west of the Mississippi furnishing by far the greater number. The flowers are mainly of a handsome blue or violet, many species and varieties running through lighter shades to pure white. The annuals are of easy cultivation, requiring, to bring them to perfection, a soil warm, sunny, and not too moist. Some species like a sandy soil, others a firmer clay. Some are erect and give the best effects when planted thickly; others are more spreading and hence require considerable space. In height they vary from only a few inches to several feet. The flowers are borne on more or less recurved racemes that straighten as the flowering proceeds. They vary from an inch long in some species to less than a quarter of an inch in others. In addition to those described below there are many other beautiful species of Phacelia, annuals as well as perennials, that should be in the trade.

1730. A modern race of fringed Petunia. (× ¼.)

Generic description: Annual or perennial plants, with alternate simple or compound leaves, and inflorescence in more or less scorpioid cymes or spikes: corolla deciduous as the capsule enlarges, with various shades of blue, purple or white; tube with or without interval appendages, these when present in the form of 10 vertical folds or projections, adnate to or free from the bases of the filaments: calyx-lobes commonly narrow, often enlarged upwards, especially in fruit: seed-coats reticulated or pitted. The plants are hairy, nearly smooth, or glandular, in whole or in part. The herbage of some of the glandular-hairy species has an offensive odor.

INDEX.

alba, 4, 5.
campanularia, 6.
campanulata, 6.
congesta, 3.
divaricata, 11.
fimbriata, 9.
glandulosa, 2.
gloxinioides, 5.
grandiflora, 5.
humilis, 1.
Menziesii, 10.
multiflora, 10.
Orcuttiana, 12.
Parryi, 7.
tanacetifolia, 4.
viscida, 8.
Whitlavia, 5.
Wrangeliana, 11.

POPULAR KEY.

A. *Plants viscid-glandular, at least above.*
  B. *Foliage simple.*
    C. *Base of lvs. usually cordate.* 6. **campanularia**
    CC. *Base of lvs. obscurely or not at all cordate.*
      D. *Corolla cleft above the middle.*
        E. *Fls. blue, with a purple or white center*........ 8. **viscida**
        EE. *Fls. blue or white all through*............... 5. **Whitlavia**
      DD. *Corolla cleft below the middle: fls. deep violet*...... 7. **Parryi**

BB. *Foliage pinnatifid to compound.*
C. *Lvs. pinnatifid, with entire lobes* .... 12. **Orcuttiana**
CC. *Lvs., at least lowest, lyrate* .. 9. **fimbriata**
CCC. *Lvs. twice pinnatifid* .... 2. **glandulosa**
AA. *Plants not viscid-glandular, or hardly so.*
B. *Foliage entire, or a few of the lower lvs. pinnately lobed...*
C. *Habit erect* .... 1. **humilis**
10. **Menziesii**
CC. *Habit spreading* ....11. **divaricata**
BB. *Foliage parted to compound.*
C. *Lvs. pinnately 3–7-parted* .... 3. **congesta**
CC. *Lvs. pinnately 9–17-divided* .. 4. **tanacetifolia**

For fear that this purely artificial key may not be found to apply with all garden plants, which are so much more liable to variation, there is given below a key based on more technical characters, derived from Gray's Synoptical Flora:

BOTANIST'S KEY.

1. SECTION EUPHACELIA. Ovules 4, a pair to each placenta; seeds generally fewer, with reticulate or pitted testa: corolla-tube with 10 laminate appendages in pairs at the base of the stamens.

A. *Lvs. all simple and entire, or nearly so* .... 1. **humilis**
AA. *Lvs. oblong or narrower, pinnately toothed to compound.*
B. *Calyx not setose-hispid.*
C. *Plant viscid-pubescent, glandular* .... 2. **glandulosa**
CC. *Plant pubescent, not viscid, or hardly so*.............. 3. **congesta**
BB. *Calyx more or less setose-hispid.* 4. **tanacetifolia**

2. SECTION WHITLAVIA. Fls. showy: seeds and ovules few to numerous: appendages 5, small and truncate or emarginate and attached to the base of each filament.

A. *Corolla purple or blue, varying to white in cultivation, the tube longer than the lobes.*
B. *Lvs. ovate or deltoid* .... 5. **Whitlavia**
BB. *Lvs. cordate* .... 6. **campanularia**
AA. *Corolla violet, rotate-campanulate, the lobes longer than the tube...* 7. **Parryi**

3. SECTION COSMANTHUS. Ovules and seeds few to numerous: appendages to the corolla none.

A. *Plant viscid*...................... 8. **viscida**
AA. *Plant sparsely hirsute*........... 9. **fimbriata**

4. SECTION EUTOCA. Ovules several to numerous: appendages to corolla 10, vertical and salient.

A. *Plant erect*.......................10. **Menziesii**
AA. *Plant diffusely spreading*........11. **divaricata**

5. SECTION MICROGENETES. Ovules not pitted nor favose-reticulated, as in the previous sections, but strongly transversely corrugated.
12. **Orcuttiana**

1731. Phacelia Whitlavia (X ⅛).

1. **hùmilis,** Gray. Annual, unbranched or branched from the base, 2–6 in. high, pubescent or inflorescence often hirsute: lvs. spatulate oblong or oblanceolate, generally obtuse, the lower rarely with 1–2 ascending lobes: spikes loosely paniculate or solitary: corolla indigo-blue, rather deeply lobed, surpassing the usually linear calyx-lobes; filaments moderately exserted, glabrous or sparingly bearded above. Calif. to Wash.—This pretty little plant seems to be unknown to the trade, but it is to be hoped it will not so remain.

1732. Phacelia viscida (X ½).

2. **glandulòsa,** Nutt. (*Eutòca glandulòsa,* Hook.). Viscid-pubescent and glandular, softly if at all hirsute, 9–12 in. or more high: lvs. irregularly and interruptedly 2-pinnatifid, or below divided; the numerous lobes oblong, small, somewhat incised, obtuse: calyx-lobes oblong or spatulate: corolla about 2 lines long, bluish, purplish or white, with lobes shorter than the tube; stamens and 2-cleft style moderately or conspicuously exserted: seeds with the minute reticulations even. Northwest Tex. to Ariz. and Mex.

3. **congésta,** Hook. Pubescent and commonly cinereous, hardly viscid or glandular in the least, a foot or more high: lvs. pinnately 3–7-divided or parted, and with a few interposed small lobes, the main divisions oblong or oval, incisely pinnatifid or irregularly lobed, the lower ones mostly petiolate and the upper confluent; calyx-lobes linear or somewhat spatulate; corolla blue, 3 lines long, the lobes as long as the tube; stamens more or less exserted: seeds reticulate scabrous, the fine sharp meshes being, as it were, toothed at the junctions. Tex. B.M. 3452. V. 5:154; 12:140.

4. **tanacetifòlia,** Benth. Erect annual, roughish hirsute or hispid, not glandular, or above slightly so, 1–3 ft. high: lvs. pinnately 9–17-divided into linear or oblong-

linear once or twice pinnately parted or cleft divisions, all sessile or nearly so, the lobes mostly linear oblong: spikes cymosely clustered, at length elongated: very short fruiting pedicels ascending or erect: calyx-lobes linear or linear-spatulate, not twice the length of the ellipsoidal capsule; stamens and style conspicuously exserted: seeds with very narrow pits bounded by thick walls. Calif. and northward. B.M. 3703.—Var. **álba**, Hort., has been offered.

5. **Whitlàvia**, Gray (*Whitlàvia grandiflòra*, Harv.). Fig. 1731. About a foot high, loosely branching, hirsute and glandular: lvs. ovate or deltoid, incisely toothed: corolla with cylindraceous ventricose tube usually an inch long, thrice the length of the lobes: appendages to the filaments hairy. Southern Calif. B.M. 4813. F.S. 11:1085. G.C. 1854:679.—A beautiful species and much cultivated, with flowers an inch long and nearly as wide. Var. **gloxinioides** (*Whitlàvia gloxinioìdes*, Hort.) and var. **álba** (*Whitlàvia álba*, Hort.) are horticultural forms with spotted and white fls. respectively.

6. **campanulària**, Gray. Lower than the last: lvs. subcordate or cordate, less deeply dentate: tube of the truly campanulate corolla ½ in. long, expanded at throat, barely twice the length of the lobes: appendages to the filaments glabrous and smaller, otherwise much like the last and almost as showy. S. Calif. B.M. 6735. G.C. II. 20:135. F. 1883:145. Gn. 31, p. 554; 55:1206. —*P. campanulata* of some is presumably this plant.

7. **Párryi**, Torr. Rather slender, 9–18 in. high: lvs. ovate, irregularly and incisely double-toothed or laciniate, or the lowest sometimes pinnately parted; the upper continue longer than their petioles: corolla cleft beyond the middle, deep violet, 8 lines across; filaments bearded: ovules on each placenta 20–30; seeds 15–20. Calif. B.M. 6842. G.C. II. 24:716.

8. **viscida**, Torr. (*Eutòca viscida*, Benth.). Fig. 1732. A foot or 2 high, branching, hirsute at base, very glandular above: lvs. ovate or obscurely cordate, doubly or incisely and irregularly dentate, 1–2 in. long: corolla deep blue, with purple or whitish center, from half to nearly an inch in diam. Calif. B.R. 21:1808. B.M. 3572. R.H. 1851:361. J.H. III. 29:183.

9. **fimbriàta**, Michx. (*Cosmánthus fimbriàtus*, Nolte). Weak and diffuse, a span high, somewhat hirsute: cauline lvs. 3–7-cleft or lobed or the lower lyrately divided, the lobes obtuse or roundish: racemes few-fld.: pedicels filiform: calyx-lobes linear-oblong or spatulate; corolla white, only 3–4 lines broad, shorter than the stamens, its lobes fimbriate. Alleghany Mts., Va. to Ala.

10. **Ménziesii**, Torrey (*Eutòca multiflòra*, Dougl.). Plant 9–12 in. high, at length paniculate-branched, hispid or roughish hirsute, usually also minutely cinereous-pubescent: lvs. mostly sessile, linear or lanceolate, entire or a few of them deeply cleft, with few or single linear or lanceolate entire lobes: spikes or spike-like racemes thyrsoid-paniculate, at length elongated and erect: corolla bright violet or sometimes white: ovules 12–16: capsule shorter than the calyx; seeds oblong, coarsely favose-reticulated. Calif. to Wash., and east to Montana and Utah. B.R. 14:1180. B.M. 3762 (*E. Menziesii*).—A beautiful species, and easily cult.

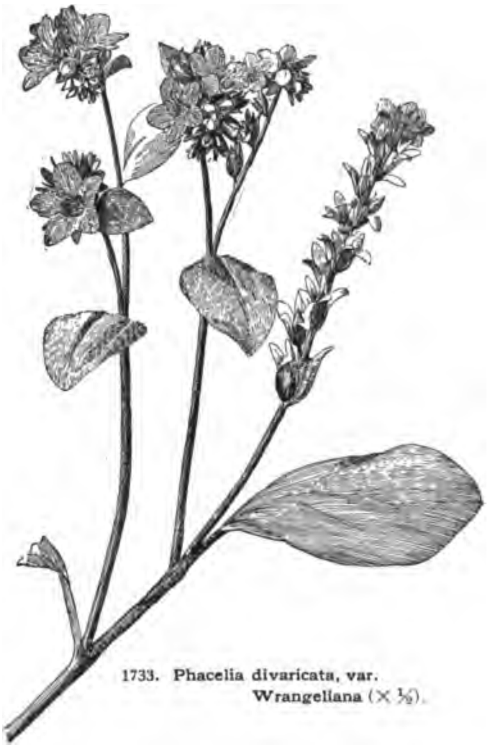
11. **divaricàta**, Gray (*Eutòca divaricàta*, Benth.). Diffusely spreading, a span high, more or less hirsute and pubescent: lvs. ovate or oblong, mostly longer than the petiole, occasionally 1–2-toothed or lobed at base, the rims curving upwards: spikes or racemes at length loose; the pedicels usually much shorter than the calyx: style 2-cleft at apex: ovules 12–20 on each placenta. Calif. B.M. 3706. B.R. 21:1784.

Var. **Wrangeliàna**, A. DC. Fig. 1733. Differs from the type only in having the lvs. inclined to be lobed or 1–2-toothed. It is known to the trade as *Eutoca Wrangeliana*, F. & M. P.M. 5:199.

12. **Orcuttiàna**, Gray. Viscid, puberulent, about 1 ft. high: lvs. pinnatifid, somewhat lyrate, the lobes short-oblong and entire: fls. sessile in the at length elongated dense spikes; corolla rotate-campanulate, double the length of the calyx, with limb 3–4 lines broad, white, with yellow eye, nearly or quite destitute of internal appendages: capsule oval, nearly equaling the narrowly spatulate (barely 2 lines long) sepals, 12–14-seeded; seeds oval, obscurely favose-reticulated between the transverse corrugations. Lower Calif.

L. F. Henderson.

PHÆDRANÁSSA (Greek, *gay queen*). *Amaryllidàceæ*. Five or 6 species of tender summer-blooming bulbs, with fls. that are tubular in appearance, borne in umbels, generally drooping and usually bright red with green tips. They are all found in the Andes at 7,000–12,000 ft., except *P. Carmioli*, a native of Costa Rica, which differs from all other species in having the perianth segments much shorter than the tube. Probably the choicest species is *P. chloracra*, the tube of which seems at first sight over 2 in. long; however, the segments are merely connivent most of the distance and it is only for a distance of a third of an inch at the base that they are really grown together into a tube. This species has 6–12 fls. in an umbel. Judging from descriptions, the showiest species should be *P. Lehmanni*, which, however, has only 3–4 fls. in an umbel and seems to have dropped out of cult. *P. gloriòsa*, Hort., recommended by some American dealers, seems to be unknown to botanists.



1733. Phacelia divaricata, var. Wrangeliana (× ½).

Generic characters: perianth subcylindrical; segments 6, equal, regular, spreading only at the tip: stamens inserted at or below the throat of the tube: ovary 3-celled; ovules many, superposed; capsule globose, loculicidally 3-valved; seeds many, small, black. The lvs. are petioled, oblong or lanceolate, produced after the fls. according to Baker, but this point is doubtful for all species. Baker, Amaryllideæ.

A. *Fls. chiefly red.*

chloràcra, Herb. Bulb globose, 2–3 in. thick: lvs. produced after the fls.: blade 8–12 in. long, 2–3 in. wide; petiole ½ ft. long, according to Baker: fls. scarlet, tipped green. Andes of Ecuador, to 12,000 ft. B.R. 31:17 (petiole 1–3 in. long).

AA. *Fls. chiefly green.*

viridiflòra, Baker. Bulb ovoid, 1½ in. thick: leaf solitary; blade ½–2 in. broad; petiole short: fls. about

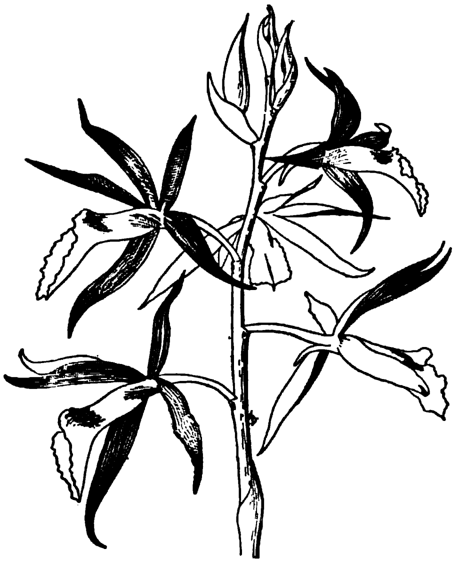
4 in an umbel, green towards the tip, without any red, passing into whitish towards the base. Andes of Ecuador.—Possibly a mere color variety of *P. chloracra*.

W. M.

PHÀIUS (Greek, *dark;* referring to the color of the fls.). *Orchidàceæ.* Often spelled *Phajus.* Very large terrestrial orchids with ample foliage and tall clustered stems terminating in racemes of showy fls.: sepals and petals similar, spreading or half-spreading; labellum large, with the lateral lobes enclosing the column, usually gibbous or spurred behind; column slender; pollinia 8. Distinguished from Calanthe by the free labellum; from Thunia by the leafless, bracted scape which does not terminate the leafy axis. Natives of tropical Asia, Africa, Australia, China, Japan, and the South Sea Islands. Heinrich Hasselbring.

Phaius is a genus of terrestrial orchids, few species of which are commercially valuable, though they are all interesting and worthy of culture in general orchid collections. The *Phaius grandifolius* group comprises, besides the type, several well-marked species and varieties such as *P. Wallichii*, *P. maculatus*, etc., all large-growing sorts of easy culture. These grow best in a moist situation at a temperature of 55° to 60° F. at night, with an advance of 10° by day, during winter months, and a moist, shady location with an active atmosphere during summer, allowing a good supply of water whenever the compost is getting dry, especially during the growing season. Good potting material consists of equal parts of chopped sod, sphagnum and well-rotted cow manure or leaf-mold. One-third of the pot space should be devoted to drainage, covered with sphagnum or rough material to keep it free and open, and the plant should be kept a little below the rim of the pot to allow space for water. They grow very well at the cool end of the Cattleya department.

P. tuberculosus, *P. Humblotii*, *P. Mishmensis* and kindred species, with their hybrids, need a very moist, active atmosphere and a trifle more heat than is required for the last group. They grow well in open, well-drained pots or baskets, in rough material composed of equal parts peat fiber, rough decaying leaves and sphagnum, chopped and mixed well together with a few nodules of charcoal. They enjoy a liberal supply of water at the roots at all seasons and should never be allowed to remain long dry. In bright weather syringing over the foliage will be found beneficial and assists in keeping down red spider and thrips. Stock is increased by dividing the plants between the pseudobulbs. After potting, give them an extra amount of water, atmospheric moisture and heat until they start new action. See also *Thunia.* R. M. Grey.



1734. Outline of Phaius Wallichii (× nearly ⅛). To show botanical structure.

A. *Fls. yellow to brown.*

maculàtus, Lindl. Pseudobulbs ovate, 2 in. high: lvs. 3–4, broadly lanceolate, plicate, 1½–2 ft. long, variegated with numerous yellowish spots: flower-stems about 2 ft. high, bearing a raceme of 10–15 yellow fls. each 2–3 in. in diam.; sepals and petals half spreading, oblong, obtuse; labellum erect, with the apex recurved, streaked with orange, wavy and crenate, sides convolute over the column, and the base prolonged into a spur half as long as the ovary. Spring. Northern India and Japan. B.M. 2719 (as *Bletia Woodfordii*); 3960. L.B.C. 19:1803.

Wállichii, Lindl. (*P. bícolor*, Lindl. *P. grandifòlius*, Lindl., not Lour. *P. grandiflòrus*, Reichb. f.). Fig. 1734. Tall: lvs. broadly elliptic-lanceolate, 3–4 ft. long: flower-stems erect, 3–5 ft. high, clothed with scales: fls. 4 in. across, varying in color from chocolate-brown to primrose-yellow; sepals and petals spreading, lanceolate, long-acuminate; labellum with an ample elongate tube; limb oblong, acute or acuminate, recurved, margin crisp; spur slender, incurved. The labellum is less variable in color than the sepals and petals. The base of the tube is yellow, dull reddish beyond, with the throat purple with yellow or red edges on the disk; apex white. Feb.–May. Trop. India, northward to the lower Himalaya. B.M. 4078; 7023. P.M. 6:193.—**P. Blùmei**, Lindl., is a form that cannot be distinguished by any botanical character. Ceylon. B.M. 6032.

grandifòlius, Lour. (*Blètia Tánkervilliæ*, R. Br.). One of the oldest orchids in cultivation. It has smaller fls. than *P. Wallichii*, with less acuminate sepals and petals and a shorter obtuse lip and spur: sepals and petals reddish brown, but variable, white on the outside; labellum white at the apex, throat and disk yellow, sides crimson. China, Australia. B.M. 1924. F.S. 7:738. L.B.C. 1:20. G.C. 1872:733; II. 18:565; III. 3:112. Gn. 3, pp. 183, 221. A.G. 20:279.

AA. *Fls. white to rose-color.*

Humblòtii, Reichb. f. Pseudobulbs, lvs. and habit like *P. grandifolius* but smaller: flower-stem 18–20 in. high, erect: fls. white and rose-colored, tinged and streaked with darker red; sepals oblong-acute; petals twice as wide; labellum spurless, lateral lobes striped with brown on a whitish ground, middle lobe light purple, with a yellow callus. Spring. Madagascar. R.H. 1891:204. G.C. II. 26:173. A.G. 12:161. A.F. 6:609.

tuberculòsus, Blume. Rhizome thick: pseudobulbs small, bearing several lanceolate lvs. 6–9 in. long: fls. 2–3 in. across, in erect spikes; sepals and petals ovate-oblong, white; lateral lobes of the labellum recurved, yellow, almost covered with brownish crimson spots, margin crenately lobed; middle lobe bifid, white, spotted with purple, having 3 thick, yellow keels; margin crisp and crenate. Feb. Madagascar. B.M. 7307. R.B. 18:145. G.C. II. 15:341; 18:565; 21:520; III. 13:237.—Difficult to grow, requiring a higher temp. than the other species.

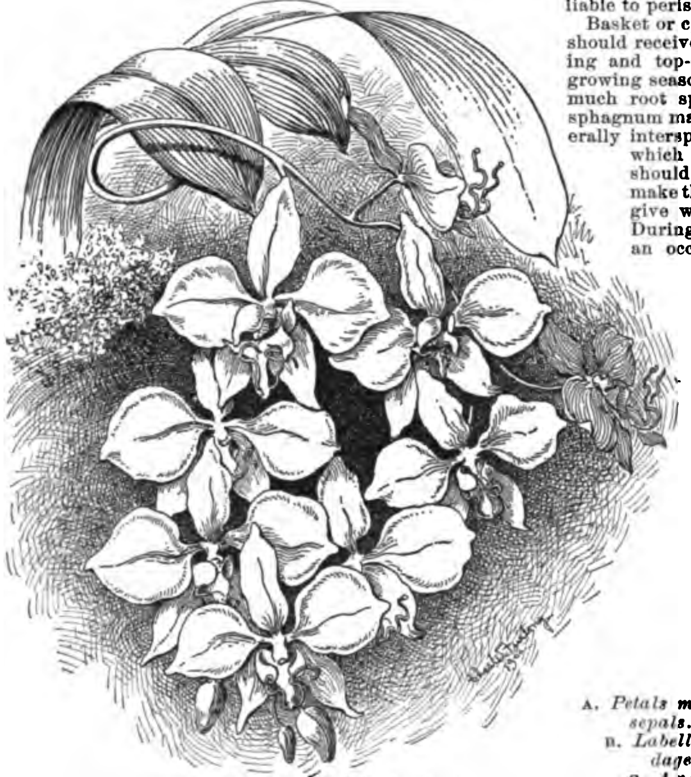
Mishménsis, Reichb. f. Stem 2–3 ft. high, leafy above: lvs. 6–10 in. long, elliptic-lanceolate, plicate: scape from the axils of the lower lvs., together with the loose raceme about 2 ft. long: fls. 2 in. across, pale or dark rose-colored; sepals linear-oblong, acuminate; petals narrower; labellum with rounded side lobes and a subquadrate, spotted middle lobe, which is somewhat 3-parted; spur slender, yellow. Himalaya Mts. B.M. 7479.

P. Ashworthiànus, Sander. A garden hybrid (P. Mannii × P. maculatus). Fls. large; sepals and petals clear old gold; labellum large, of the same color, with many radiating chocolate lines, outer surface clear yellow. G.M. 40:551.

Heinrich Hasselbring.

PHÀJUS. See *Phaius*, above.

PHALÆNÓPSIS (Greek, *moth-like;* suggested by the large white fls. of some species). *Orchidàceæ.* This genus, called by Lindley "the grandest of all orchids," contains some of the most magnificent species to be found in the orchid family. The plants are natives of the hot regions of India and the Malay Archipelago, growing on trunks of trees and sides of rocks under conditions of high temperature and great moisture. The flowers are remarkably beautiful in form and color. Those of the larger species are borne in graceful drooping panicles, on which they usually all face in one direction.



1735. **Phalænopsis amabilis** (× ¼). See No. 1.

The plants are of monopodial growth, having short stems which increase slowly in length: lvs. few, thick, leathery, often mottled: inflorescence a raceme or panicle, large, or not longer than the lvs.: sepals spreading, the lateral ones more or less united with the base of the column: petals about as large as the sepals or very much broader; labellum variously shaped but united with the base of the column. About 40 species.

HEINRICH HASSELBRING.

The species of Phalænopsis are all truly epiphytal, and are found growing in their native habitats on rocks and trees at very low altitudes or at sea-level in moist but often exposed situations where the rains during their growing season are frequent and excessive, and the temperature registers 70°-75° F. during the night and as high as 90°-95° F. during the day. They are principally natives of the Philippine Islands, eastern India, Malaya, Sumatra, Java and Borneo, many of the individual species growing over a wide range of territory.

With but few exceptions, they grow best in the warm portion of the East Indian house where a temp. of 65°-70° F. at night and about 75° F. during the day, or 85° with solar heat, can be maintained through the winter months. The summer temp. may range about 70° F. at night and 80° or 85° by day. Air should be admitted in greater or less degree at all times to keep the atmosphere active, but direct drafts must always be avoided. Shade is necessary except in December and January, but should never be sufficiently heavy to exclude indirect solar influence, as plants grown with overabundant shade, heat and moisture make weak tissue and a thin cuticle incapable of withstanding extremes in temperature and humidity to which they are subjected more or less during the winter months. Such careless treatment invariably results in either wet or dry spot, and the plants, having no pseudobulbs, are liable to perish.

Basket or cylinder culture suits them best, and they should receive all necessary attention, such as rebasketing and top-dressing, at the commencement of their growing season in Feb. or Mar., but they do not require much root space at any time. Chopped live coarse sphagnum makes the best compost; this should be liberally interspersed with rough pieces of charcoal, to which the roots cling freely. The compost should be worked in firmly about the roots to make the plant steady. During the resting period give water when the compost is becoming dry. During the growing season water freely and give an occasional overhead syringing. When the plants are flowering profusely weak liquid cow or sheep manure may be given once a week with good effect.

There is no special means of propagation; young plants are often produced on the flower-scapes, and the old flower-scapes if bent down on the wet sphagnum can sometimes be induced to send up young plants.

R. M. GREY.

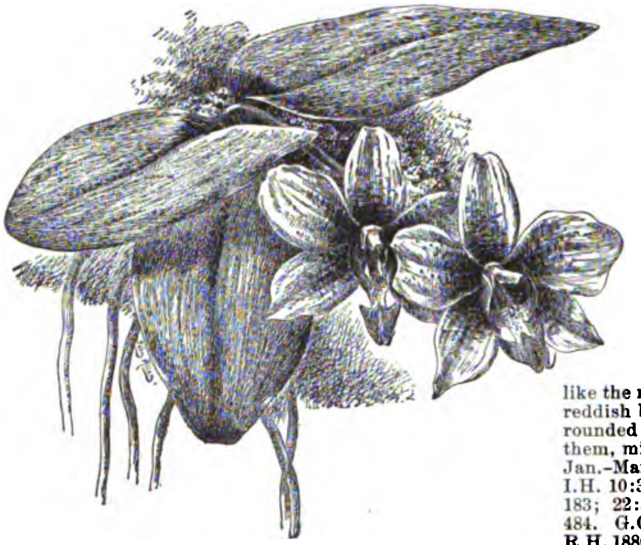
INDEX.

amabilis, 1, 2.
amethystina, 8.
antennifera, 7.
Aphrodite, 2.
aurea, 1.
casta, 2.
Cornu-cervi, 10.
Dayana, 2.
Esmeralda, 7.
gloriosa, 2.
grandiflora, 1.
Harriettæ, 1.
intermedia, 3.
leucorrhoda, 2.
Lowii, 6.
Lüddemanniana, 13.
ochracea, 13.
Parishii, 14.
Portei, 3.
Porteri, 3.
punctatissima, 4.
rosea, 15.
Sanderiana, 2.
Schilleriana, 5.
speciosa, 11.
Stuartiana, 4.
Sumatrana, 12.
violacea, 9.

A. *Petals much broader than the sepals.*
  B. *Labellum with apical appendages: rostellum short.*
    C. *Apical appendages cirrhous.*
      D. *Middle lobe very narrow*.................. 1. **amabilis**
      DD. *Middle lobe trowel-shaped*............... 2. **Aphrodite**
    CC. *Apical appendages short, horn-like.*
      D. *Lvs. green*............. 3. **intermedia**
      DD. *Lvs. mottled, at least when young.*
        E. *Fls. white*........... 4. **Stuartiana**
        EE. *Fls. rose-purple*..... 5. **Schilleriana**
  BB. *Labellum without apical appendages: rostellum long*...................... 6. **Lowii**
AA. *Petals scarcely or not at all broader than the sepals.*
  B. *Claw of the labellum with horn-like appendages below the lateral lobes*...... 7. **Esmeralda**
  BB. *Claw of the labellum without appendages.*
    C. *Apex of the labellum notched*................. 8. **amethystina**
    CC. *Apex of the labellum entire.*
      D. *Rachis compressed: bracts fleshy.*
        E. *Middle lobe of the labellum fleshy, rounded*........... 9. **violacea**
        EE. *Middle lobe of the labellum crescent-shaped*............10. **Cornu-cervi**

DD. *Rachis terete.*
E. *Labellum laterally compressed, fleshy*.11. **speciosa**
EE. *Labellum expanded.*
F. *Middle lobe densely hairy* ....12. **Sumatrana**
FF. *Middle lobe pilose*.13. **Lüddemanniana**
FFF. *Middle lobe smooth.*
G. *Labellum crested*..14. **Parishii**
GG. *Labellum not crested, but provided with a fleshy callus*....15. **rosea**

1. **amábilis**, Blume, not Lindl. (*P. grandiflòra*, Lindl.). Fig. 1735. Lvs. long, pale green: fls. variable in size, sometimes nearly 5 in. across, pure white with stains of deep yellow and a few purple spots on the labellum and on the column; dorsal sepals ovate to oblong, lateral sepal lanceolate; petals rounded-fan-shaped; lateral lobes of the labellum obliquely cuneate, incurved, middle lobe very narrow with yellow cirrhi. Autumn. Malay Arch. B.M. 5184. G.C. 1848:39; II. 26:213. Gn. 19, p. 305; 24, p. 560; 34, pp. 516, 517. R.H. 1860, pp. 238, 239; 1897, p. 151. A.G. 16:271.—Var. **aùrea**, Rolfe (*P. grandiflòra*, var. *aùrea*, Warner). Front half of the lateral lobes of the labellum and the entire middle lobe stained deep yellow. Borneo. **P. Hárriettæ**, Rolfe, is a garden hybrid between *P. amabilis* and *P. violacea*. Fig. 1736. Fls. intermediate between the parents, 4½ in. across; sepals and petals pale yellowish white, suffused and dotted with amethyst-purple toward the base; labellum crimson with an orange crest; cirrhi slightly developed. G.C. III. 2:9. Gn. 38:766.



1736. Phalænopsis Harriettæ (× ¼). See No. 1.

2. **Aphrodite**, Reichb. f. (*P. amábilis*, Lindl., not Blume). Lvs. elliptic-lanceolate, 1 ft. or more in length, dark green, obliquely retuse: fls. 3 in. in diam., pure white, with the labellum streaked and spotted with yellow and red; sepals elliptic-ovate; petals large, rhomboid; lateral lobes oblong, middle lobe trowel-shaped, with white cirrhi. Fls. at various seasons, but most freely during summer. Philippines. B.M. 4297. B.R. 24:34. P.M. 7:49. F.S. 1:40. G.C. 1848:39; II. 26:213. Gn. 31, p. 273; 35, p. 362; 38, p. 157; 48, p. 484. R.H. 1897, p. 150. A.F. 6:89.

Var. **Dayàna**, Hort. (*P. amabilis*, var. *Dayàna*, Hort.), has regular flowers with the lower sepals minutely dotted with crimson, the labellum also being heavily marked with bright crimson. A.G. 21:457.

Var. **cásta**, Rolfe (*P. cásta*, Reichb. f.). Lvs. thinly spotted: fls. like the type, with a rosy tint especially at the base of the sepals and petals, and a few spots at the base of the lateral sepals.—Scarcely distinct from the following, but distinct from the type.

Var. **leucorrhòda**, Rolfe (*P. leucorrhòda*, Reichb. f.). Lvs. blotched with gray in irregular bands: sepals and petals flushed with rose, the former yellowish outside: callus yellow, spotted with purple. Philippines. F.M. 1875:166. R.H. 1896:500.

Var. **Sanderiàna**, Rolfe (*P. Sanderiàna*, Reichb. f.). Fls. suffused with rose; labellum variegated with brown, purple, and yellow. Island of Mindanao. Gn. 24;407; 57, p. 44.

Var. **gloriòsa** (*P. gloriòsa*, Reichb. f.). Fls. white, with a rose-colored spot on the labellum. Gn. 35:697.

3. **intermèdia**, Lindl. A natural hybrid between *P. Aphrodite* and *P. rosea*. Resembles *P. Aphrodite* in habit but the fls. are smaller. Sepals oblong, acute, white; petals rhomboid, much larger, white with few rose spots at the base; labellum small, lateral lobes erect, rose-purple spotted with crimson, middle lobe rich crimson, terminating in 2 short horns. Philippines. —The same type has been artificially produced by crossing the two parent species.

Var. **Pórtei**, Reichb. f. (*P. Pórteri*, Hort.). Fls. large, stained with rose-purple: lvs. about 1 ft. long, deep green. G.C. II. 5:369, 371. F.M. 1875:162. J.H. III. 30:179. Gn. 21:326. G.M. 38:111.

4. **Stuartiàna**, Reichb. f. Lvs. elliptic-oblong, obtuse, about 1 ft. long, mottled when young, becoming dull green above and reddish below; panicle large, branched, drooping: fls. 2 in. across; sepals elliptic, obtuse, white or greenish white, the lateral ones speckled with red; petals rounded but obscurely quadrangular, white with few purple dots at base; labellum golden yellow or orange spotted with crimson, white at the tip, lateral lobes obliquely obovate, obtuse, with a pair of cuneate calli between them; middle lobe orbicular, ending in 2 white cirrhi. Jan., Feb. Philippines. B.M. 6622. I.H. 31:540. F. 1882:49. Gn. 22:348; 45, p. 426. G.C. II. 16:753; III. 4:389. J.H. III. 34:157. F.E. 11:393.—Very near *P. Schilleriana*, but very different in color. Var. **punctatíssima**, Hort., has the sepals and petals profusely spotted with purplish red.

5. **Schilleriàna**, Reichb. f. Fig. 1737. Lvs. 6–18 in. long, oblong, dark green and mottled with gray above, purple below: panicle drooping, flat, as much as 3 ft. long and nearly as broad, bearing often over 100 fls. each 2½–3 in. across: dorsal sepals obovate, acute, the lateral ones ovate, rich rose-lilac; petals large, rhomboid, colored like the sepals; labellum colored like the rest of the flower or paler and often spotted with reddish brown and having a yellow callus; lateral lobes rounded-oblong, with 2 quadrangular calli between them, middle lobe oval, ending in two divergent horns. Jan.-March. Philippines. B.M. 5530. F.S. 15:1559. I.H. 10:348; 35:56; 43, p. 154. S.H. 2, p. 47. Gn. 3, p. 183; 22:348; 33, p. 615; 35, p. 363; 38, p. 157; 48, p. 484. G.C. II. 12:301; III. 3:529; 17:367. F.M. 1877:257. R.H. 1886:396. A.G. 14:65. G.F. 4:390. A.F. 11:1081.

6. **Lòwii**, Reichb. f. Lvs. 4–5, oblong, fleshy, deep green, tinged with purple: panicle slender, 5–20-fld.: fls. 1½ in. in diam., white flushed with purple; dorsal sepals broadly ovate, lateral sepals oblong; petals fan-shaped, with a rounded apex; labellum violet-purple, lateral lobes small, reflexed, middle lobe oblong; rostellum very long-beaked. Fls. during summer months. Moulmein (India). B.M. 5351. F.S. 18:1910. Gn. 9:14. G.C. III. 2:745.

7. **Esmerálda**, Reichb. f. (*P. antennifera*, Reichb. f.). Lvs. oblong, acute, 4–8 in. long, gray-green with few dull purple spots: raceme erect, 6–10-fld., 6–18 in. high: fls. about 1 in. in diam., dark or pale purple to white with red streaks; lateral sepals ovate, dorsal sepals obovate; petals obovate; labellum clawed, 3 lobed, lateral lobes ovate to rotund, erect, yellowish; middle lobe broad, obtuse, deep purple; claw with a slender appendage on each side. Cochin China, etc. B.M. 7196. F.M. 1879:358. R.H. 1877, p. 107.

8. **amethýstina,** Reichb. f. A small species with cuneate-oblong lvs.: fls. small, cream-colored with an amethyst labellum; sepals cuneate-oblong, obtuse; petals subequal or a little smaller; lateral lobes of the labellum cuneate; middle lobe obovate, notched. Malay. G.C. 1870:1731.

9. **violàcea,** Teijsm & Binn. Lvs. oblong, 8–12 in. long, light shining green: flower-stalks not longer than the lvs.: fls. few, 2 in. across; sepals and petals broadly lanceolate, yellowish white, changing to rose-violet toward the base; middle lobe of the labellum fleshy, deep purple, with a yellow callus; side lobes small, erect, purple and orange. May–Oct. Sumatra. F.M. 1879:342. G. C. II. 16:145.—Plant of dwarf habit. The fls. remain on the plant a long time.

10. **Cornu-cérvi,** Blume & Reichb. f. Lvs. about 9 in. long, leathery, oblong: flower-stem about as long as the lvs., erect, clavate, bearing 6–12 fls.: fls. yellowish green, barred with reddish brown; sepals and petals fleshy, lanceolate, the latter smaller; labellum whitish, lateral lobes erect on the irregular, fleshy, excavated claw, middle lobe crescent-shaped, apiculate. Summer. Trop. Asia, Java and Sumatra. B.M. 5570 (as *Polychilos Cornu-cervi*).

11. **speciòsa,** Reichb. f. Lvs. oblong: fls. stellate, in racemes or panicles, white, blotched with rose-madder; sepals oblong; petals narrower; labellum with erect, linear, toothed, yellow side lobes, and a fleshy, purple and white middle lobe ending in a hairy cushion. Andaman Islands (Bay of Bengal). G.C. II. 18:745; 26:277.

12. **Sumatràna,** Korth. & Reichb. f. Lvs. pointed, about 6 in. long: inflorescence about as long as the lvs., 6–10-fld.: sepals oblong, pointed, 1 in. or more in length; petals more cuneate; all yellowish white barred, with bands of reddish brown; labellum short, clawed; lateral lobes erect, meeting and each having a short curved tooth pointing backwards; middle lobe oblong, fleshy, white, streaked with violet, very hairy in front. Sumatra and Borneo. B.M. 5527. F.S. 16:1644. G.C. 1865:507.

13. **Lüddemanniàna,** Reichb. f. A small plant, with thick, oblong fleshy lvs. 6–8 in. long: inflorescence about as long as the lvs., with few handsome fls. near the top: fls. 2–3 in. across; sepals and petals oblong-acute, white, marked with transverse bars, those at the base being amethyst, while the upper ones are brown; labellum deep violet, with yellow blotches on the side lobes; middle lobe oblong; side lobes erect, ligulate, deeply 2-toothed. Feb., March. Philippines. B.M. 5523. F.S. 16:1636. R.H. 1872:390. F. 1865:257.—The old flower-stems of this plant produce young plants by which the species may be easily increased.

Var. **ochràcea,** Reichb. f. A form with yellowish fls. and ochre-colored bars. R.H. 1872:390.

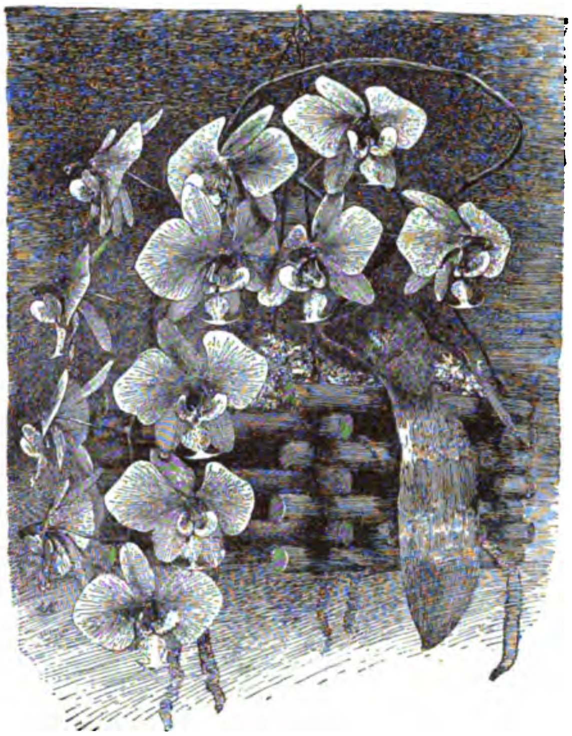
14. **Párishii,** Reichb. f. Dwarf: lvs. oblong-lanceolate, acute, 2–4 in. long: fls. in 6–10-fld. racemes scarcely longer than the lvs., crowded; dorsal sepals oblong, lateral broadly ovate, white; petals obovate-spatulate, white; lateral lobes of the labellum small, horn-like, yellow, with purple spots, middle lobe broadly triangular, red-purple, often white on the disk; crest semilunar, broken up into subulate filaments in front; the disk has a peculiar appendage ending in 4 long subulate filaments. Burma and Moulmein. B.M. 5815.

15. **ròsea,** Lindl. Lvs. oblong, dark green, obliquely retuse: scape about a ft. long, nodding, dark purple, bearing 12–14 fls.: sepals and petals ovate, obtuse, white, tinged with pink in the center; labellum rose-colored, scarcely longer than the sepals; lateral lobes small, lunate, middle lobe ovate. Philippines. B.M. 5212. F.S. 16:1645. G.C. 1848:671.

P. Lísterii. Advertised, but doubtful.—*P. Válentini*, Reichb. f. Plant of the habit of P. violacea, with narrower lvs.: sepals cuneate-oblong, purple, with the lateral sepals white at the base; petals like the lateral sepals or barred with purple; labellum short, clawed, mauve, white and yellow. Malay.

HEINRICH HASSELBRING.

PHALÁNGIUM Liliástrum. See *Paradisea Liliastrum.*



1737. Phalænopsis Schilleriana (× ⅙). See No. 5.

PHÁLARIS (old Greek name used by Dioscorides, probably from *phalos*, shining; in allusion to the shining seed). *Gramineæ.* Ten species, mostly of southern Europe, one native throughout the northern part of North America, a variety of which is the Ribbon Grass. *P. Canariensis*, Canary Grass, which is cultivated in Europe for bird-food or sometimes as a cereal, is occasionally found in this country along roadsides. This annual species, on account of its variegated ovate spikes, is worthy of cultivation as an ornamental grass. Spikelets 1-fld., collected in heads or spike-like panicles. Empty glumes 4, but the second and third minute. Outer glumes boat-shaped, awnless.

arundinàcea, Linn. REED CANARY GRASS. A tall perennial (2-6 ft.) with flat ½ in. wide lvs. and an elongated spike-like panicle (open in anthesis) of whitish spikelets, native through northern America in wet ground, where it is an important forage grass. Recommended for planting in parks and grounds along the banks of streams or artificial ponds. A very striking native grass.

Var. **variegàta** (var. *picta*). RIBBON GRASS. GARDENER'S GARTERS. Fig. 1738. Lvs. longitudinally striped with white. Commonly cult. for ornament and sometimes run wild about old places.

A. S. HITCHCOCK.

PHALOCÁLLIS (Greek words referring to the delicacy of the cone formed by the crests). *Iridàceæ.* Referred by Baker to Cypella. The plant offered as *P. plumbea*, Herb., by Dutch bulb-growers is **Cypélla plúmbea,** Lindl., a South Brazilian species differing from those described at p. 429 as follows: corm large: lvs. lanceolate: stem stout, 2–4 ft. long: fls. dull lilac; outer segments 1¼–2 in. long; inner with a small obovate blade and long claw; style-branches 2-fid, each fork with 1 erect and 2 spreading spurs. B.M. 3710 (fls. chiefly lilac). F.S. 4:395 (chiefly light blue). F.S. 14:1466 (*flore striato*, veined and flushed with rich purple shades on a white ground).

PHÁRBITIS. See *Ipomœa.*

1738. Ribbon Grass—Phalaris arundinacea, var. variegata. (See page 1293.)

PHASÈOLUS (ancient Latin name, somewhat altered, of a bean). *Leguminòsæ.* BEAN. Annual or perennial mostly twining herbs, or some of them woody at the base, with mostly pinnately 3-foliolate stipellate leaves, axillary peduncles bearing clusters of white, yellow, red or purplish papilionaceous flowers, and more or less compressed (flat-sided) several to many-seeded 2-valved pods. Many species have been described, all of warm countries, but there are probably not more than 100 kinds that can be clearly separated as species. From its allied genera, Phaseolus is separated by minute characters of calyx, style and keel. In Phaseolus the style is bearded along the inner side, and the stigma is oblique or lateral rather than capitate on the end of the style; the keel is coiled into a spiral body, including the 10 diadelphous stamens (in 9 and 1).

Since Phaseoli are tropical or warm-country plants, they must not be subjected to frost. Most of them are garden annuals which are given a warm place after all danger of frost is past. One of them, *P. Caracalla*, is sometimes grown as a greenhouse climber, but in California and other warm parts it thrives in the open and climbs hedges and trees, often smothering them. The culture is set forth under *Bean*, but the species are contrasted below. See, also, *Canavalia, Glycine, Mucuna, Vicia, Vigna.*

INDEX.

aconitifolius, 5.
adenanthus, 2.
amœnus, 2.
Caracalla, 1.
carinatus, 8.
cirrhosus, 2.
compressus, 8.
ellipticus, 8.
fœcundus, 7.
glaber, 6.
gonospermus, 8.
inamœnus, 7.
latisiliquus, 7.
Limensis, 7.
lunatus, 7.
macrocarpus, 7.
multiflorus, 3.
Mungo, 6.
nanus, 8.
oblongus, 8.
puberulus, 7.
radiatus, 6.
retusus, 4.
saccharatus, 7.
sphæricus, 8.
Truxillensis, 2.
vulgaris, 8.
Xuarezii, 7.

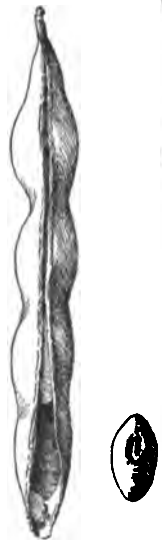
A. *Perennial tall-twining species, with large, fragrant, showy fls., and nearly or quite glabrous lvs.*

1. **Caracálla,** Linn. CARACOL. SNAIL-FLOWER. CORKSCREW-FLOWER. Leaflets broadly rhombic-ovate, pointed or acuminate: fls. large and fleshy, in axillary racemes, light purple to yellowish, very fragrant, the large keel coiled like a snail shell. Tropics, probably of the Old World. B.R. 4:341. V. 2, p. 370.—Naturalized in parts of California, where it grows 20 or more feet high, sometimes becoming a nuisance. It is an old-fashioned glasshouse plant in cold climates, but is now rarely seen. It is sometimes planted out in summer.

2. **adenánthus,** Meyer (*P. amœnus*, Soland. *P. Truxillénsis*, HBK. *P. cirrhòsus*, HBK.). Foliage much like that of the last, the lfts. ovate and somewhat acute: fls. very showy, red (or light blue ?), fragrant, in dense almost capitate clusters: pod 4–6 in. long, usually curved. Tropics; grown sparingly in southern California.

AA. *Perennial from tuberous roots (but P. multiflorus grown as an annual N.), the fls. either large or small, the lvs. pubescent or scabrous.*

3. **multiflòrus,** Willd. SCARLET RUNNER BEAN. DUTCH CASE-KNIFE BEAN (a white variety). Fig. 1739. Root thickened and tuberous, perennial in the South but perishing in the North: plant tall-twining and slender, minutely pubescent: lfts. thin, rhombic-ovate and acute, scabrous-pubescent: fls. rather large and showy, in racemes, in the Scarlet Runner type red, in the Dutch Case-Knife white, the keel not distinctly projecting: pods long (3–6 in.), with a curved slender type: beans large and plump, much flattened or nearly cylindric, red and black in the Scarlet Runner, white in the many other forms. South American or Mexican, but now widely spread.—The Scarlet Runner form is popular as an ornamental vine for arbors and to cover windows, sometimes being known as Flowering Bean or Painted Lady. The Dutch Case-Knife is a vegetable-garden plant, grown for its beans. Various forms of the plant are grown for food by the Mexicans, and these sometimes appear in our western country. Melde's Perennial and Irvine's Hybrid beans are apparently white-fld. forms. The color of flower and seed seems always to be associated in this species. A dwarf or "bush" form, probably of *P. multiflorus*, was introduced a few years ago as Barteldes' Dwarf Lima (see Bull. 87, Cornell Exp. Sta.). Fig. 1740. It is not unlikely that more than one species is passing as *P. multiflorus*, some of the Mexican forms being imperfectly understood.

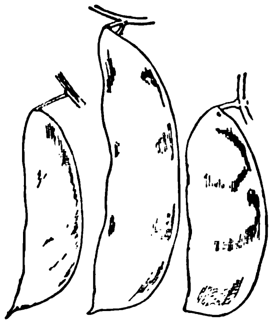


1739. Phaseolus multiflorus (× ⅛). White-seeded form.

1740. Barteldes Bush Lima (× ⅓). Probably a form of *Phaseolus multiflorus.*

4. retùsus, Benth. Metcalfe Bean. Root very large, said sometimes to weigh 30 lbs., running deep into the ground: stem trailing, roughish: lfts. rhombic to oblong, mostly obtuse and often retuse, rough on both sides: fls. in loose, interrupted racemes, rather small, purple: pod flat, short, broadly oblong, somewhat curved. Tex., west and south.—Lately recommended as a forage plant in the dry regions of the Southwest. The lvs. are thick and heavy and well adapted to dry, hot climates. Stems grow 8–10 ft. or more long.

1741. Sieva Bean—Phaseolus lunatus (× ⅓)



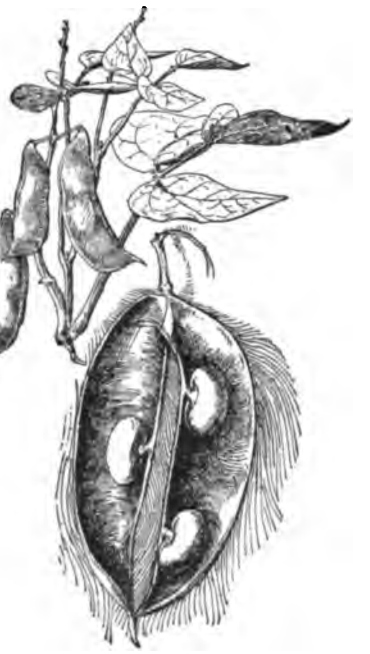
1742. Pods of Sieva, Large Lima, Potato Lima (× ⅓).

The two last are forms of *P. lunatus*, var. *macrocarpus*.

AAA. *Annual (at least in the N.), either twining or "bush," the lvs. mostly pubescent, cult. for food.—Garden beans of various kinds.*

B. *Pod usually ¼ in. or less broad: usually not climbing.*

5. **aconitifòlius,** Jacq. Moth Bean. A diffuse, bushy or somewhat trailing plant with loosely brown hairy slender stems, growing 1–2 ft. tall: lfts. mostly ovate to rhombic-ovate, 2–3-lobed at the apex for one-fourth to one-half their length, the lobes narrow and obtuse; stipules small, narrow and pointed: fls. very small, yellowish, in heads on the ends of hairy axillary peduncles: pod becoming 2 in. long, nearly cylindrical, glabrous. India, where it is cult. for human food and for forage, but only rarely seen in collections in this country. It is said to be able to withstand much dry weather.



1743. Henderson Dwarf Lima, a form of Phaseolus lunatus (× ⅓).

6. **Múngo,** Linn. Gram. Erect or nearly so, 1–2 ft., stout, with the furrowed stems densely clothed with long brown hairs: lvs. large and long-stalked; lfts. very broadly ovate or nearly rhomboid-orbicular, usually entire, thin, short-acute: stipules large, ovate: fls. rather small, yellowish, in a capitate cluster of 5 or 6 on the end of the stout hairy peduncle: pod 3 in. or less long, nearly cylindrical, somewhat curved, bearing 10–15 beans. S. Asia, where it is everywhere cultivated for human food.—Rarely seen in this country. In habit it somewhat resembles the Soy bean (Glycine). The slender pod is hairy at first, but the hairs are deciduous. It is very variable. From botanists it has received many names.

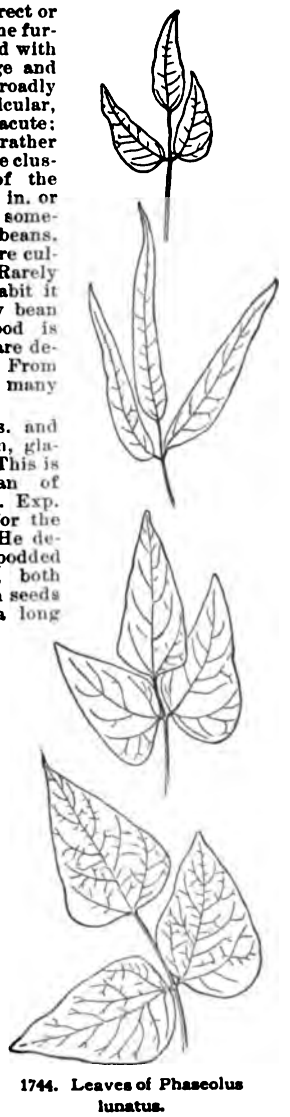
Var. **glàber,** Roxbg. Lvs. and pod, and sometimes the stem, glabrous.—A domestic form. This is probably the Adzuki bean of Georgeson, Bull. 32, Kans. Exp. Sta., where it is praised for the high quality of the bean. He describes 2 forms, the White-podded and Black-podded Adzuki, both with small red or brownish seeds with truncated ends and a long narrow scar. Pods 3–5 in. long.

Var. **radiàtus,** Hook. f. (*P. radiàtus*, Linn.). Stems twining, all parts densely hairy.

BB. *Pod usually ½ in. or more broad: plants naturally climbing, but giving rise to "bush" forms.*

C. *Beans large and usually flat.*

7. **lunàtus,** Linn. Sieva or Civet Bean. Figs. 1741–4. Small and slender, usually not climbing very high: lfts. thin, short and broad, ovate-pointed (except in special forms, as the Willow-leaf): fls. of medium size, white or whitish, in axillary racemes: pods small and papery, 2–3 in. long, much curved on the back and provided with a long tip, splitting open when ripe and the valves twisting: beans small and flat, white, brown or mottled. Trop. America.—Widely cult. in warm countries, and prized for its earliness and prolificacy. It gives rise to dwarf or bush forms, as the Dwarf Carolina, Henderson Bush Lima (Fig. 1743). Common in American gardens.



1744. Leaves of Phaseolus lunatus.

Two upper ones, Willow Leaf, a very narrow-leaved form of the Sieva type; middle one, Potato Lima; lowest one, Large White Lima, the two later being var. *macrocarpus*.

Var. **macrocárpus,** Benth. (*P. inamœnus*, Linn. *P. Liménsis, sacchardtus, fœcúndus, latisíliquus*, Macfadyen. *P. pubérulus*, HBK. *P. Xuarézii*, Zucc.). Lima Bean. Figs. 1742, 1744. Distinguished from the Sievas by tall, robust growth and late ripening: lfts. large and thick, ovate-lanceolate: pods fewer to the raceme, straight or nearly so, without a prominent tip, not readily splitting at maturity: beans very large, white, red, black or speckled. South Amer.—Widely grown in the tropics, and one of the richest of beans. Unreliable in the northern states because of the short, cool seasons. There are two forms in cult. in the U.S.: Flat- or Large-seeded Limas, with seeds very flat and veiny and more or less lunate in shape, and very broad flat pods, with a distinct but not prominent pod, and broad-ovate lfts.; Potato Limas, with smaller tumid seeds, shorter and thicker pods, with a very short point, and long-ovate, tapering lfts., with angular base. In both these groups there are dwarf or bush forms,—Burpee Dwarf Lima in the former, and Kumerle Dwarf Lima in the latter. The Lima Bean is perennial in the tropics.

1745. Leaf of Phaseolus vulgaris.

cc. *Beans relatively small, oblong and nearly cylindrical.*

8. **vulgàris**, Linn. Common Bean. Kidney Bean of the English. Haricot of the French. Figs. 1745–7. Slender, twining, more or less pubescent: lfts. rhombic-ovate or ovate, acuminate: peduncles shorter than the petioles, few-fld. at or near the apex: fls. small, white, yellowish or blue-purple: pod slender, somewhat curved, provided with a straight or curved tip. Now believed to be tropical American.—Here belong all the common garden pole beans, aside from the Lima types, including the Pole Cranberry (Fig. 1747), and so-called Horticultural Lima. Runs into very many forms.

Var. **nànus** (*P. nànus*, Linn.). Bush Bean. A domesticated race, differing only in its dwarf or "bush" habit. It is now the more popular type, particularly in America, since it requires no labor in providing poles or other support. This includes all the common garden and field beans.

1746. Long-podded forms of Phaseolus vulgaris.

For a history of garden or kidney beans, see Georg von Martens, "Die Gartenbohnen," 1869. He makes 7 specific types and many subtypes or botanical varieties. His species are: *P. vulgaris*, Savi. Pod straightish and subtorulose, long-mucronate; seeds somewhat compressed, oblong-reniform. *P. compressus*, Martens Climbing: pods compressed and broad, short-mucronate; seeds strongly compressed, oblong-reniform. *P. gonospermus*, Savi. Climbing: pod subincurved, torulose and short-mucronate; seeds somewhat compressed and irregularly angular-truncate. *P. carinatus*, Martens. Climbing: pod falcate and rugose; seeds teretish, elongated, somewhat truncate-carinate. *P. oblongus*, Savi. Dwarf, erect: pod subcylindrical, straightish, long-mucronate; seeds subreniform-cylindric, twice longer than broad. *P. ellipticus*, Martens. Low, erect or somewhat climbing: pod straightish, more or less torulose; seeds small, tumid-elliptic. *P. sphæricus*, Martens. Nearly erect, or climbing: pod straightish and constricted; seeds large and subglobose.

L. H. B.

PHEASANT'S EYE. *Narcissus poeticus*, *Dianthus plumarius*, and *Adonis*.

PHEGÓPTERIS (Greek, *beech-fern*). *Polypodiàceæ.* Beech, Oak or Sun Fern. A genus of ferns allied to Dryopteris in habit, but with no indusium, the sori being entirely naked. There are numerous tropical American and Sandwich Island species worthy of cultivation in warmhouses. Three of our native species are sometimes offered in the trade. For culture, see page 575.

A. *Fronds (lvs.) small or medium-sized, at most tripinnatifid. (Native species.)*

B. *Lvs. bipinnatifid, broadly triangular.*

hexagonóptera, Fée (*Polypòdium hexagonópterum*, Michx.). Lvs. 9–15 in. long, usually broader than long, pale green; lower pair of pinnæ deflexed and set forward; sori marginal. Eastern U. S.

polypodioides, Fée. Lvs. 5–9 in. long, longer than broad, dark green, slightly hairy beneath; sori nearer the margin than the midrib. Eu. and northeastern N. Amer.

BB. *Lvs. tripinnatifid, lanceolate.*

alpéstris, Fée. Lvs. 1–2 ft. long, 6–8 in. wide, with numerous finely cut lanceolate pinnæ, the lobes toothed; thinly herbaceous. Eu. and northwest Amer. Has the habit of *Asplenium filix-fœmina*

BBB. *Lvs. ternately tripinnatifid.*

Dryópteris, Fée. Oak Fern. Lvs. triangular, 3–9 in. each way, the lowest pinnæ nearly equal to the central (terminal) portion, giving the leaf a ternate appearance. Eu. and N. Amer.

1747. Cranberry Pole Bean — Phaseolus vulgaris (× ½).

AA. *Fronds (lvs.) several feet long, decompound.*

Kerandreniàna, Gaud. Lvs. several feet long, decompound with light brownish polished stalks, and straw-colored rachides; texture herbaceous; sori near the margins of the segments. Sandwich Islands. Also advertised under *Polypodium*.

L. M. Underwood.

The American species are of easy culture in shady places, and increase rapidly by creeping rootstocks. The fronds are light green, of a distinct and attractive hue. They have the fault of dying down for the season before the summer is over, especially when growing in rather dry positions. *P. polypodioides* prefers a moist, shaded place. It is not so quickly deciduous as the other two species. *P. hexagonoptera* is suited for almost any shaded position. The fronds often die down in August, and at this season are occasionally much and handsomely variegated with pure white. *P. Dryopteris* is one of the most beautiful of small American hardy ferns. It is eminently suited to shady rockwork, though it completes its growth early in the season.

F. W. Barclay.

PHELLODÉNDRON (Greek, *phellos*, cork, and *dendron*, tree; alluding to the corky bark). *Rutàceæ.* Ornamental deciduous trees with large, opposite, odd-pinnate lvs., inconspicuous greenish fls. in short terminal panicles and black frs. *P. Amurense* is quite hardy as far north as Mass., but *P. Japonicum* is somewhat tender; the first has been recommended as a street tree for western cities, as it resists drought and heat in summer and seems to be not attacked by insects. It is of rapid growth when young and forms a rather low, round head. It seems to grow in almost any kind of soil except in a very moist one. Prop. by seeds, which are produced freely when both sexes are planted and by root cuttings, dug up in fall and stored during the winter in moist sand or sphagnum. Two closely related species in E. Asia and Japan. Fls. diœcious, in terminal short panicles; sepals and petals 5–8, ovate-lanceolate; stamens 5–6, longer than petals: ovary 5-celled, with a short, thick style: fr. a black drupe with 5 small one-seeded stones.

Amurénse, Rupr. CHINESE CORK TREE. Tree, to 50 ft., with spreading branches forming a broad, round head; bark of the trunk light gray, corky; almost glabrous: lfts. 7–17, ovate to ovate-lanceolate, narrowed or rounded at the base, long-acuminate, minutely crenulate, dark green and somewhat shining above, glaucescent and glabrous beneath or pubescent only on the midrib: fr. globose, black, about ⅓ in. across, with a strong turpentine-like odor when bruised. June. N. China, Amurland, Japan.

Japónicum, Maxim. Closely allied to the preceding. Lfts. ovate, rounded or truncate at base, acuminate dull green above, pubescent beneath, with rather prominent veins; leaf-stalk and inflorescence pubescent. June. Japan.—Less hardy than the preceding and probably only a variety of it; but sometimes thrives in New England.

ALFRED REHDER.

PHENOLOGY (contraction of *phenomenology;* that is, the science of phenomena): the study of the relationships between the climate of any place and the annual periods of plants and animals. Plants vegetate, bloom, and ripen fruit at more or less definite seasons, each after its kind; animals mate, bear young, migrate and hibernate each also after its kind; but these recurring events are related to the climate in which these things live: with these inter-relationships Phenology has to do. The most complete means of comparing the climate of one year with that of another are the life-events of the animals and plants of the years. Thermometrical readings are the customary measures, but the thermometers record only temperature, whereas local climate is modified by conditions of humidity, cloudiness, the sequence of atmospheric changes, and many subtle agencies which cannot be measured by means of instruments. Living things are the agents that really measure climate. A record of the life-events of living things, therefore, even though imperfect, should contribute to the science of climatology; and incidentally it should contribute much to the science of biology. Records of plant-events are more comparable than those of animal-events, because plants are stationary and have no volition to adapt themselves to inclemencies by means of change of position, diet, or otherwise; therefore, plants emphatically express climatal influence. A record of the first blooming of a given apple tree, for example, during a series of years would give comparable measures of the lateness or earliness of the different seasons. Most so-called phenological observations in this country have been mere records of dates of blooming, leafing, migration of birds, peeping of frogs, and the like, without correlative data respecting the local climate. They are therefore of relatively little consequence to science. In this country the literature of Phenology is very meager. See Bailey, Essay 17, "Survival of the Unlike," and "Instructions for taking Phenological Observation," "Weather Review," Sept., 1896, U. S. Weather Bureau.

L. H. B.

PHILADÉLPHUS (name of an ancient Egyptian king; applied to this genus with no obvious reason). *Saxifragàceæ.* MOCK ORANGE. SYRINGA. Ornamental deciduous or rarely half-evergreen shrubs with opposite entire or serrate lvs. and white showy fls. in terminal racemes or solitary on short branchlets, appearing mostly in June and often very fragrant. Most of them are hardy North except *P. Coulteri*, *Mexicanus* and the other Mexican species; *P. tomentosus* and *Billardi* are only half-hardy. They are well adapted to shrubberies and are mostly of medium height, the tallest being *P. pubescens,* which grows to about 20 ft.; *P. Gordonianus* and *P. inodorus* grow nearly as high, while *P. microphyllus* hardly exceeds 3 ft. They thrive well in almost any well-drained soil and even under trees. If pruning is needed it should be done after flowering, since the fls. appear on the wood formed the previous year. Prop. usually by hardwood cuttings, or by suckers and greenwood cuttings under glass; also by layers and by seeds, but they are very apt to hybridize when several species are growing together.

About 30 species have been described. They are distributed through the northern hemisphere; in N. Amer. south to Guatemala and from southeast Europe to Himalayas and Japan. All are shrubs with exstipulate, petioled more or less distinctly 3-nerved lvs.: fls. solitary or racemose; calyx-lobes, petals and styles usually 4; stamens 20–40: fr. a dehiscent, 4-valved, many-seeded capsule. Owing to the absence of well-marked characters the species are often rather difficult to distinguish, and this difficulty is much increased by the numerous hybrids which have originated in cultivation. The latest account of this genus is a short monograph by E. Koehne in Gartenflora, Vol. 45 (1896), p. 450, etc., where 33 species are distinguished, of which 20 are American.

It seems strange that Philadelphus is popularly known under the name of Syringa, a very different genus of no botanical affinity and little resemblance; but this is only continuing the usage of the old herbalists who used to unite under Syringa species of Philadelphus, Syringa and Jasmine. Thus we find in Gerarde's "Herball," first published in 1597, descriptions and figures of *Syringa alba*, White Pipe, *S. cærulea*, Blue Pipe, and *S. Arabica*, Arabian Pipe, the first being *Philadelphus coronarius*, the second *Syringa vulgaris* and the third *Jasminum Sambac*. This accounts also for the German popular name Jasmine for Philadelphus. In French Syringa has been changed to Seringa, and is used in this form as the popular name for Philadelphus. Linnæus decided to take up the name Syringa for the *S. cærulea* of the older botanists and *Syringa alba* he called Philadelphus, a name previously used for the same plant by some of the old herbalists.

1748. Philadelphus coronarius—Mock Orange (× ⅓).

INDEX.

argenteo-marginata, 8.
aureus, 8.
Avalanche, 10.
Boule d'argent, 10.
Californicus, 5.
Candélabre, 10.
coronarius, 6, 8.
dianthiflorus, 8.
erectus, 10.
Falconeri, 7.
floribundus, 1, and suppl. list.
Gerbe de Neige, 10.
Gordonianus, 2.
grandiflorus, 1, 12.
hirsutus, 13.
inodorus, 12.
latifolius, 1.
laxus, 11.
Lemoinei, 10.
Lewisi, 3.
microphyllus, 14.
Mont Blanc, 10.
multiflorus plenus, 8.
nanus, 8.
nivalis, 1.
Pekinensis, 6.
primulæflorus, 8.
pubescens, 1.
rosæflorus, 8.
salicifolius, 8.
Satsumi, 4.
speciosissimus, 9.
speciosus, 11.
spectabilis, 1.
trinervius, 13.
undulatus, 11.
Yokohamæ, 4.
Zeyheri, 9.

A. *Bark of last year's branches not peeling off: fls. in racemes.*

B. *Calyx pubescent outside: bark gray.*

1. **pubéscens,** Loisel. (*P. latifòlius*, Schrad. *P. grandiflòrus*, var. *floribúndus*, A. Gray). Shrub, to 20 ft. high: mature branches of this year yellowish brown, those of last year light gray: lvs. broadly ovate, dentate, pubescent beneath, 2–4 in. long: racemes rather loose, 5–11-fld.: fls. creamy white, scentless, 1½–2 in. across. June, July. Tennessee. B.R. 7:570 and Gn. 40, p. 289 (as *P. grandiflorus*). B.R. 23:2003 and G.C. II. 16:81 (as *P. speciosus*).—The figures quoted above do not represent typical plants; they are probably partly hybrids of this species with *P. grandiflorus* and *inodorus*, but the figure accompanying the original description by Loiseleur in Herbier gen. de l'amateur, Vol. IV, t. 268, agrees well with wild plants from Tennessee. A dwarf form with double fls., cult. as *P. nivalis spectabilis flore pleno*, probably belongs to this species. *P. pubescens* of Koch and of Koehne is *P. verrucosus;* see supplementary list.

1749. Philadelphus coronarius.

BB. *Calyx glabrous outside: bark brown or grayish brown.*

2. **Gordoniànus,** Lindl. Shrub, to 12 ft., with grayish brown branches: lvs. broadly ovate to elliptic, coarsely dentate, especially those of the young shoots, light green, pubescent beneath, thin, 1½–3 in. long: racemes dense, 5–7-fld.: fls. pure white, scentless, 1½–1¾ in. across; petals oval-oblong: ovary half-superior. June, July. Wash. to Ore. B.R. 25:32. Gn. 3, p. 233.

3. **Léwisi,** Pursh. Upright shrub, to 8 ft.: bark of branches dark or grayish brown, usually with numerous horizontal cracks: lvs. broadly ovate or elliptic-ovate, entire or sparingly dentate, glabrous or somewhat hairy beneath, thickish at maturity, 1½–3 in. long: racemes short and dense, 5–9-fld.: fls. short-stalked, 1-1⅓ in. across, scentless. June, July. Brit. Colo. to Calif.

4. **Satsùmi,** Sieb. (*P. Yokohàmæ*, Hort.). Shrub, to 8 ft., erect: branches of last year with grayish brown bark, usually marked with whitish, longitudinal fissures: lvs. ovate, long-acuminate, dentate or sometimes entire, almost glabrous, 3–6 in. long: racemes loose, erect, 7–9-fld.: fls. about 1 in. across, slightly fragrant. May, June. Japan.

AA. *Bark of last year's branches peeling off in thin flakes, brown.*

B. *Fls. in many-fld. panicles, but sometimes racemose on weaker branches.*

5. **Califórnicus,** Benth. Upright shrub, to 8 ft., with brown branches: lvs. ovate, with few teeth or almost entire, glabrous or somewhat pubescent beneath, thickish at maturity, 1½–2½ in. long: fls. ¾–1 in. across, scentless; petals oblong. June, July. Wash. to Calif. —Similar in habit to *P. Lewisi*, to which it is usually referred as a variety.

BB. *Fls. in 5–9-fld. racemes, rarely 3.*

C. *Lvs. glabrous or nearly so beneath, ovate-lanceolate: pedicels glabrous.*

6. **Pekinénsis,** Rupr. (*P. coronàrius*, var. *Pekinénsis*, Maxim.). Upright shrub, to 5 ft.: lvs. ovate-lanceolate, acuminate, denticulate, thickish at maturity, 1½–3 in. long; petioles purplish: racemes short and dense, usually 5–11-fld.: fls. 1⅓ in. across, slightly fragrant; style divided only at the apex. May, June. Mongolia, N. China.—Dense, upright, but rather low, free-flowering shrub.

7. **Fálconeri,** Sarg. Shrub, to 8 ft., with slender, arching branches: lvs. ovate-lanceolate, acuminate, denticulate, 1½–3 in. long, thickish at maturity: fls. 3–7, slender-pedicelled, fragrant, pure white, about 1½ in. across; calyx-lobes lanceolate; petals oblong, acute; style much longer than stamens, deeply divided. June. Origin unknown; probably Japanese. G.F. 8:497. M.D.G. 1899:231. Gng. 8:340.—Very graceful shrub, wide-spreading.

CC. *Lvs. more or less pubescent beneath, usually ovate.*

8. **coronàrius,** Linn. Fig. 1748, 1479. Shrub, to 10 ft., with upright branches: lvs. ovate to ovate-elliptic, usually acute at both ends, denticulate, sparingly pubescent beneath, 2–4 in. long: fls. 5–9 in rather dense racemes, creamy white, very fragrant, on rather short pubescent pedicels; petals oval; style divided about one-half. May, June. S. E. Eu., Caucasus. B.B. 2:186.—This is the common Mock Orange, less showy than the following species and of somewhat stiff habit, but deliciously fragrant. There are several vars. in cultivation. Var. **argénteo-marginàta,** Hort. Lvs. edged creamy white, and other variegated forms. Var. **aùreus,** Hort. Foliage yellow. Var. **nànus,** Schrad. Dwarf, compact shrub, with dark green foliage; flowers but rarely. Var. **salicifòlia,** Hort. Lvs. lanceolate or linear-lanceolate. There are also several vars. with double fls., as vars. **dianthiflòrus, multiflorus plènus, primulæflòrus** (R.H. 1870, p. 305), **rosæflòrus,** mostly of dwarfer habit than the type.

9. **Zéyheri,** Schrad. Probably hybrid of the preceding and *P. inodorus:* lower than *P. coronarius* and more spreading, with sometimes arching branches: lvs. ovate, usually rounded at the base: fls. usually 5, pure white, slightly fragrant or scentless, 1½–1¾ in. broad; style sometimes longer than stamens, divided one-half or less. June. Of garden origin. The different forms of *P. Zeyheri* are, besides those of the following hybrid, the most showy of the genus, bearing the large, pure white fls. in great profusion along the branches. *P. speciosissimus*, Hort., belongs here.

10. **Lemóinei,** Lemoine. Hybrid of *P. microphyllus* with *P. coronarius*, of varying habit: lvs. ovate to ovate-elliptic or ovate-lanceolate, usually pubescent beneath and ¾–2½ in. long: fls. 3–7 in short racemes, very sweet-scented; petals oval to oblong, mostly dentate at the apex. G.F. 2:617.—Some of the best forms of this hybrid are **Avalanche.** Graceful shrub, with slender arching branches, covered almost the whole length with showy white fls. G.C. III. 21:89. M.D.G. 1896:293. **Gerbe de Neige** is similar, but the fls. are larger. **Boule l'argent** has large, double fls. and the habit of *P. coronarius*. G.C. III. 18:19 and 23, suppl. 28 May. **Candélabre.** Low shrub, with upright branches covered with large fls. M.D.G. 1896:294. Var. **eréctus.** Upright, to 5 ft., covered with white fls. **Mont Blanc** is similar in habit, but fls. larger and showier.

BBB. *Fls. 1–3, occasionally 5.*

C. *Flowering branchlets 2 in. or more long, with 2 or 3 pairs of rather large lvs.: pedicels and calyx glabrous.*

11. **láxus**, Schrad. (*P. unduldtus*, Hort. *P. speciòsus*, Schrad.). Shrub, to 8 ft., with spreading slender branches: lvs. elliptic-ovate to oblong-lanceolate, entire or sparingly denticulate, often slightly recurved and pendulous, sparingly appressed pubescent beneath, 2–4 in. long: fls. oftener solitary, scentless, 1–1½ in. across; style as long as stamens. May, June. S. C. to Tenn. and Fla. B.R. 2:186. Gng. 8:340.—This species is closely allied to the following, and perhaps best considered a mere variety of it.

12. **inodòrus**, Linn. (*P. grandiflòrus*, Willd.). Shrub, similar to the former, but usually more upright and more vigorous: lvs. broadly ovate to elliptic-ovate, usually dentate, bearded in the axils of the veins beneath, 3–5 in. long: fls. 1–3, occasionally 5, 1½–2 in. broad, scentless; calyx-lobes ovate-lanceolate, twice as long as ovary; style often longer than stamens. May, June. N. C. and Tenn. to Ga. B.R. 25:39 (as *P. laxus*). B.M. 1478. The *P. inodorus* of Gray differs in its smaller, often entire lvs. and smaller, usually solitary fls. with short ovate calyx-lobes.—Some forms of this species, and especially the preceding species, have proved tender north, but most are hardy.

CC. *Flowering branchlets usually 1 in. or less long, with rather small lvs.*

13. **hirsùtus**, Nutt. (*P. trinérvius*, Schrad.). Upright or spreading shrub, to 6 ft.: lvs. ovate-acuminate, serrate, pubescent above, grayish tomentose beneath, 1–2½ in. long: fls. 1–3, on short branchlets with usually 1 pair of lvs., creamy white, 1–1½ in. across, scentless; calyx pubescent; style short, with connate stigmas. N. C. to Ala. and Texas. Gn. 26, p. 375; 34, p. 138. S.B.F.G. II. 2:119. B.R. 24:14.—This species is less decorative than most of the others. It differs from all Asiatic and most N. American species by its winter-buds being not enclosed in the base of the petioles, while all others except a few southwestern species have the small winter-bud enclosed in the base of the petioles, and they are therefore not visible until the lvs. have fallen off.

14. **microphýllus**, Gray. Shrub, to 3 ft. high, with spreading slender or rigid branches: lvs. oblong-ovate, entire, appressed pubescent on both sides or almost glabrous, glaucescent beneath, ½–1 in. long: fls. 1–3, white, about 1 in. across, very fragrant; calyx glabrous or appressed-pubescent. New Mex. to Calif. and Colo. G.C. III. 2:156. Gn. 40:824. P.G. 5:109.—One of the most distinct species, deliciously fragrant; likes sunny, well-drained position.

P. acuminàtus, Lange, is hardly different from P. Satsumi, but lvs. larger and broader.—*P. Billárdi*, Koehne (P. pubescens Souvenir de Billard, Hort.). Lvs. broadly ovate, pubescent beneath, large: fls. in many-fld. panicles, rather large; calyx pubescent. Origin unknown.—*P. Chinénsis*, Hort. = P. Satsumi.—*P. Columbiànus*, Koehne. Closely allied to P. Gordonianus, but lvs. smaller, with only 1–4 coarse teeth on each side. Calif.—*P. cordifòlius*, Lange. Closely allied to P. Californicus, but panicle very many-fld., leafy near the base. Origin unknown.—*P. Coùlteri*, Wats. Allied to P. Mexicanus, but calyx and lvs. densely covered with grayish pubescence. N. Mex. G.F. 1:233.—*P. floribùndus*, Schrad. Similar to P. coronarius: lvs. more pubescent beneath, fls. larger and less fragrant. Probably hybrid of P. pubescens and P. inodorus.—*P. Godohòkeri*, Kirchn. = P. hirsutus; but also P. laxus is sometimes cult. under this name.—*P. Kochiànus*, Koehne, is a form of P. Zeyheri, with the style exceeding the stamens.—*P. Mexicànus*, Schrad. Half-evergreen shrub with spreading branches, allied to P. hirsutus: lvs. sparingly pubescent: fls. 2 in. across, fragrant; stigmas not connate. Mex. to Guatemala. B.R. 28:37. R.H. 1852:381. G.C. II. 19:753. B.M. 7600. Not hardy north. —*P. Nepalénsis*, Koehne. Allied to P. Pekinensis: lvs. broader, pubescent in the axils of the veins beneath; petioles not purplish. Himalayas.—*P. Schrénkii*, Rupr. Allied to P. coronarius. Upright.: lvs. large and thin: fls. scentless, smaller; style appressed pubescent at the base; petals narrow. Manchuria. —*P. tenuifòlius*, Rupr. Allied to P. coronarius: with slender spreading branches: lvs. almost glabrous, thin: fls. small, scentless; petals narrow. Manchuria, Amurland.—*P. tomentòsus*, Wall. Allied to P. coronarius: lvs. pubescent on both sides, tomentose when young. Himalayas.—*P. umbellàtus*, Koehne. Probably hybrid of P. inodorus and P. coronarius, or an allied species: fls. in broad 2–15-fld. panicles, compound of long-peduncled cymes. Origin unknown.—*P. verrucòsus*, Schrad. (P. pubescens, Koch, not Loisel.). Allied to P. pubescens, but bark brown: Fls. smaller. Origin unknown.

ALFRED REHDER.

PHILAGÈRIA. Consult *Lapageria* and *Philesia*.

PHILÈSIA (Greek, *lovely*). *Liliàceæ*. A member of the lily family with the general appearance of some common northern shrub is certainly an extraordinary thing. Philesia is such a shrub, growing 3–4 ft. high, near the Straits of Magellan, and bearing showy pendulous, red, Lapageria-like fls. about 2 in. long. It is far removed from the ordinary lily types with 6 similar perianth-segments, for it has a distinct calyx of 3 sepals and 3 petals. It is closely allied to Lapageria, but differs in habit, in the calycine character of the outer perianth and the monadelphous stamens. This plant is very rare in cultivation. It is said to live outdoors in the most favored localities of England and Ireland.

Magellánica, J. F. Gmel. (*P. buxifòlia*, Lam.). Much branched: lvs. alternate, linear-oblong, 1–1½ in. long, leathery, evergreen, feather-veined, glabrous, glaucous beneath; margins reflexed; petiole jointed at the junction of the blade: fls. solitary, bright rosy red; petals wavy; filaments united into a tube below the middle, then free: ovary 1-celled, with 3 short parietal placentæ which bear several ovules: fr. a berry. B.M. 4738. F. 1854:65. G.C. II. 18:105.

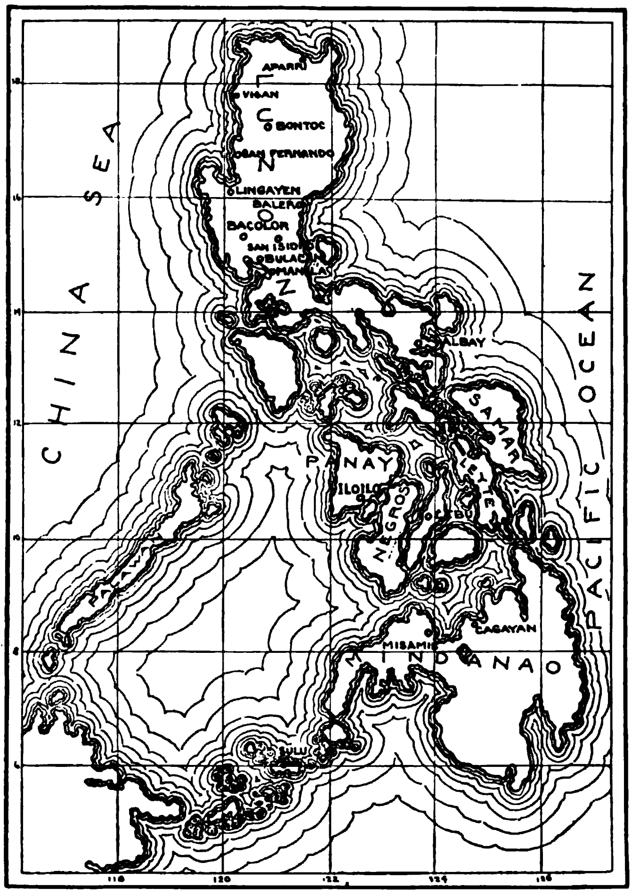
W. M.

Philesia is too slow-growing ever to become very popular. The undersigned cultivated this plant more than 20 years ago, but has not seen a specimen of it for many years, and does not know where to find one at the present time. It is a short-jointed, hard-wooded shrub, with rather leathery, box-like leaves, and will grow to about 4 feet in height in time. It is an Andean species closely related to Lapageria, which fact will account for that bigeneric hybrid known as *Philageria Veitchii*. Philesia is said to be found from Chile down nearly to the Straits of Magellan, and should, therefore, be nearly or quite hardy. In the writer's experience with it this plant was grown in a Camellia house, in which a night temperature of 45° was maintained, the plants being firmly potted in a light, peaty soil. It flowered but sparingly in the latter part of the summer. The flowers were borne only singly in the axils of the leaves. Cuttings may be rooted when taken from ripened growth, but require careful management in a cool temperature, and are usually several months in rooting. If one tries to grow Philesia in too high a temperature the general result is a good crop of thrips and a case of general debility, much as with *Pernettya mucronata* under similar conditions. The writer does not consider Philesia extraordinarily hard to manage, provided it is kept cool and in a dewy atmosphere, but it will positively rebel against forcing.

W. H. TAPLIN.

PHILIPPINE ISLANDS, HORTICULTURAL CAPABILITIES OF. Fig. 1750. The Philippine Archipelago occupies about 700 miles of longitude and 1,000 miles of latitude (from 4.40° to 20° north lat., and from 116.40° to 126.30° east long.), just across the China Sea from the mainland of Asia. The equatorial current passes its southern border, the Kuroshiwo originates near the northern limit, the eastern portion is influenced by the Pacific drift, and over the whole the summer monsoon bears its rain-laden clouds. Of the 1,200 or 1,300 islands constituting the group, many are scarcely more than mountain peaks thrust above the sea, and less than 30 have an area worthy of special consideration. In general the mountains bear in a northerly direction and rise to such height as to materially influence the rainfall. The mountains are not, in the main, abrupt and forbidding, but the elevations are gradual and deeply indented with valleys, affording innumerable fertile plats along the slopes. The area of the islands is given as 114,356 square miles, of which a large percentage is arable. Luzon has about 36 per cent of the total area and Mindanao 29 per cent. The temperature is not extreme and is remarkably uniform on the islands of the archipelago. The observatory at Manila reports that the average temperature of December—the coldest month—for the 17 years prior to and including 1896 was

77°, and for May—the warmest month—82.9°, while the mean temperature during that period was 80.42°. The rainfall averages for February .46 in. For the 5 dry months, Dec., Jan., Feb., Mar. and Apr., the total average is 5.47 in., and for the 6 wet months, June, July, Aug., Sept., Oct., and Nov., the total average is 65.65 in. Observations show that the islands differ from one another but slightly in temperature, while there is considerable variation on the same island due to altitudes. Portions of Luzon are cool the entire year. Upon the basis usually allowed in tropical countries for decrease in temperature due to elevation, an elevation of 5,000 ft. would give an annual mean of 60.42°. There are tablelands where the mean would not be over 70° F. Different portions of the same island show also wide divergence in rainfall owing to mountain ranges.



1750. Philippine Islands, to show the general form of the archipelago.

The soils are quite varied, including not only all the grades from sandy to stiff clay, but limestone, slaty, volcanic, alluvial, etc.

While the Philippines are adapted by climate and soil to the production of almost everything that can be grown in the tropics, the Spaniards, pursuing their usual policy, limited their production to very narrow lines. North Luzon, including the extensive valley of the Rio Grande de Cagayan and its affluents, was chiefly devoted to tobacco; the low, flat, clay loam lands east and north of Manila, including most of the provinces of Manila and Bulacan and a portion of Pampanga, is farmed in rice. To the south of Manila the provinces of Batangas, Cavité and Laguna produce considerable coffee; while the long, irregular promontory forming the southeast of Luzon, with its moist, volcanic soils, is the hemp region. Some of the smaller islands south of Luzon, particularly Masbate and Ticao, produce hemp principally. Large quantities of sugar are produced in Luzon, chiefly on the sandy loam and alluvial lands in the provinces of Pampanga, Cavité and Laguna, though sugar estates may be found in nearly all portions of this island. Sugar is the principal product of Panay, Negros and Cebu. The following report of the principal exports of the Philippines for 1897 gives a condensed statement of the present agricultural situation:

Manila hemp	**$8,571,850**
Sugar	**6,911,535**
Coffee	**45,648**
Tobacco and cigars	**2,128,380**
Coconnuts and copra	**2,687,978**
Sapan wood	**23,323**
Indigo	**50,825**
Liquid indigo	**21,554**
Ylang Ylang oil	**24,937**
Candlenut oil	**15,755**
Candlenuts	**19,464**
Copal	**22.562**
Fruits	**8,393**
Aloe fiber	**13,687**
Sesame	**2,592**
Betel-nuts	**382**

The principal cereals that can be produced are rice, corn, barley and tropical wheat. The general plan for producing rice is very crude. The rice is planted in a seed-bed, properly prepared, the last of April. The fore part of June, after the rainy season has saturated the soil, the native takes his water buffalo and plows a small field, previously surrounded by a levee. The water and soil make a thin mud; into this he sets the rice plants from a seed-bed, or he occasionally sows his rice broadcast. The heavy succeeding rains flood the field and perfect the crop, which usually matures and is harvested in December. At harvest the rice is hand-cut with an implement similar to a corn hook, but lighter. The rice is bound in small bundles, and when partially dry is laid upon the levees in ricks with the heads hanging over the bank. When cured the grain is removed with the hatchel or by tramping.

There are large areas adapted to the production of maize, but the Indian rarely gives much attention to cultivation; hence the results are small, except upon new lands. With more knowledge of the maize plant and with more industry it should be a profitable crop. Barley and glutinous wheat are winter crops, suited to the climate and well adapted to supplement the food supply. Limited quantities of beans are produced. It is not probable that any of the cereals will be raised in surplus quantities, sufficient for export. Fiber material, sugar, tobacco, fruits and nuts will continue to be the leading exports, with a rapid increase of the last two, under American control.

The Philippines are more celebrated for their fiber than for any other product. The best known is Manila hemp (*Musa textilis*), though there is some export of Aloe fiber (maguey) and pineapple cloth (piña). Manila hemp grows luxuriantly on the rich volcanic soils of the southern Luzon peninsula. It belongs to the same family with the banana, and its growth is similar. The trunk is 8–10 in. in diam. and is formed entirely of concentric leaf-stems or petioles. It is 8–10 ft. high at maturity. It is renewed by offshoots that spring from the base of the old plant, which are also used to set new fields. One setting of a plantation is good for ten years. As soon as the trunk is mature it is cut and each of the thick, fleshy leaf-sheaths of which it is composed is removed. The leaf-stem is then placed on a bench; a bar of wood with teeth on the under side is firmly pressed upon it while two men pull the stem, scraping the pulpy material from the fiber. The fiber is then hung up to dry. Four men will clean 150 pounds

of fiber, worth $12, per day. They receive one-half for cleaning.

Vegetables.—The great variety of vegetables that can be grown in the Philippines and the constant supply that might be had from a well-tended garden, indicate the source from which the people should obtain their principal food. As far as can be observed, gardening is not especially in the line of the Filipino. The Japanese accomplish marvels in gardening by the use of human excreta, both solid and liquid; the Filipino has, in addition, the excreta of the water buffalo, but he rarely has what can be properly called a garden. He may have small patches of beans, sweet potatoes and taro, but nothing approaching a garden, except cultivated for the city market. The traveler in the Philippines is impressed with the high culture of the people along some lines and their total lack in others. Gardening is one of their deficiencies, and it is the more surprising from their proximity to China and Japan. The following well-known vegetables are produced in the islands:

Beans of many varieties, beets, carob bean, celery, cabbage, cassava, carrot, cucumber, eggplant, garlic, gourd, lettuce, lentil, muskmelon, onion, okra, pumpkin, pea, pepper of all kinds, peanut, potato, radish, sesame weed, sweet potato, turnip, taro, tannier, tomato, watermelon, yam.

Fruits.—The banana, fruit of *Musa sapientum* (Figs 187, 188), is abundant in all portions of the islands. Except on the coffee plantations it is mainly produced close to the native huts, where it supplies shade and furnishes food. The principal variety sold in the local markets is the Guinea. The fruit of this variety is 4–5 in. long, peeling thin, flesh rich, yellow and firm, mainly eaten fresh. The plantain (*Musa paradisiaca*) may be treated in the same connection. It is larger and a more vigorous producer than the banana and is usually eaten cooked. With rice it constitutes the principal food of the Filipino. First it is produced with little labor, an important consideration in tropical countries; second, it adds an agreeable flavor to the rice; third, it ripens almost continuously throughout the year; fourth, it produces more food per acre than any other fruit or any cereal. Cases are reported in which 40,000 lbs. of the edible portions of the plantain have been produced per acre. This would give nutritive material per acre as follows: protein, 520 lbs.; fat, 240 lbs.; carbohydrates, 8,400 lbs. Fifteen hundred lbs. of cleaned rice per acre (larger than any Philippine crop) would furnish protein 120 lbs., fat 45 lbs., carbohydrates 1,182 lbs. The plantain is dried and ground or pounded into flour for food. To transport bananas and plantains to the United States would require steamers with some refrigeration, or the fruit would be too ripe on arrival.

1751. Typical house near Manila. Roof made of the Nipa Palm.

1752. A typical laborer's hut in Manila. Also made of Nipa Palm,—a *casa de nipa*.

The coffee plant, *Coffea Arabica* (Fig. 514), grows luxuriantly in the sheltered ravines of the mountains of the entire group; but the principal portion for export is grown in Cavité, Batangas, Laguna and in the mountains bordering the western coast of Luzon. In flavor it is similar to the Java and is highly prized in the markets to which it has been shipped. There is a variety of coffee produced in Mindanao called Zamboanga. It has a larger berry than the Manila and is not so highly prized. Its principal market is Singapore. Coffee-growing requires high-class agriculture, and for this reason it has never flourished in the Philippines as the climate and the conditions warrant. Several things should be carefully observed in coffee-farming: the young plant should be root-pruned and transplanted once or twice before final setting in the orchard; holes 2½ ft. square and 2 ft. deep should be dug and filled with soil, for each plant in the permanent orchard—holes 8 ft. apart; coffee trees should be pruned annually; the shade trees or plants should not be such as will draw heavily upon the soil and should not be so dense as to give more than a partial shade. The best and the poorest coffee are the product of the same tree, hence the necessity of great care in production and grading. With a full development of the coffee industry the Philippines probably could supply the entire annual imports of the United States (831,827,063 lbs. in 1899) to the mutual profit of both countries.

1753. A hay (rice grass) carrier in Manila.

Oranges, lemons and limes are produced abundantly. They are, however, of an inferior quality, due to variety and lack of cultivation and of pruning. The orange trees are exceedingly healthy and vigorous. In the hands of the Filipino the orange is practically a product of nature. No effort has been made to improve the fruit by the general introduction of better varieties, nor to improve the quality by selection, cultivation, fertilization and pruning. There is scarcely any limit to the supply of this luscious fruit that could be produced annually if science and industry should be directed to planting it upon the elevated tablelands of these islands. The soil on large areas is well adapted to the citrous fruits. The abundant rainfall during the fruit-growing season and the dry weather during the period of ripening, are conditions that will not be overlooked by the intelligent horticulturist in the future. What has been said of oranges is equally applicable to lemons, limes and grape fruit.

The shaddock, *Citrus Decumana*, of which grape fruit or pomelo is the best variety, is a native of the Malayan and Polynesian islands and is at home in the Philippines. This fruit sometimes attains great size (15 lbs.), but is too coarse for commerce. The demand for the large, juicy, subacid pomelo has always been much in excess of the supply, and this, if it could be obtained abundantly, would rank in consumption with oranges and lemons. See *Citrus* and *Pomelo*.

Pineapple, the collective fruit of *Ananas sativus* (Fig. 83), finds a congenial habitat on the sandy coast lands and in the warm, rich valleys of these islands. Under these conditions the plant with care attains large size and the rich, saccharine juice develops its highest flavor. The pineapple is propagated by setting the suckers, which spring from the base, in rows 4 ft. apart and 2 ft. in the row. This requires about 5,000 plants per acre. It bears fruit in 18 to 20 months. Carefully cultivated the fruit should weigh, on an average, 6–8 lbs. Occasionally specimens are found weighing 16 lbs. There are many cultivated varieties and they vary much in size and quality. With encouragement it would soon become an important branch of commerce. Up to this time they have been grown simply for home consumption and for the exquisite fiber, sometimes called "pineapple silk," obtained from the leaves.

Guava, fruit of *Psidium Guava*, has been acclimatized and finds genial conditions. The beauty of the tree, the fragrance of the flowers and the utility of the little, subacid, juicy fruit, make it a favorite garden tree wherever it can be grown. Its excellence for jelly is known, but it has not yet attained commercial importance in the Philippines. See *Guava* and *Psidium*.

Chocolate bean, fruit of *Theobroma Cacao*, is a small tropical evergreen, bearing an elongated, egg-shaped fruit 5–10 in. long, containing numerous seeds the size of a chestnut, imbedded in a sweet pulp. These seeds are known in commerce as chocolate beans, and both in the green and dry state are used by the natives as food. They contain about 50 per cent of oil and have an agreeable flavor. For manufacture, the seeds, after the removal of the husk, are roasted, then ground into an oily paste which is mixed with sugar and flavored, forming the chocolate of commerce. As yet, the bean has been produced in a limited quantity, but the industry could be developed into a large business. See *Theobroma*.

All the spices are at home in these islands. Allspice, fruit of the ***Pimenta officinalis*** (Figs. 1804–5), a beautiful evergreen, attaining a height of 30 ft.; nutmeg, fruit of the ***Myristica fragrans*** (Figs. 1452, 1453), a bushy evergreen 40–50 ft. high; and ginger, the rhizome of ***Zingiber officinale*** (which see), a perennial plant, reed-like, with annual stem 3–4 ft. high, have been tested and are or can be produced in the islands. Cinnamon, inner bark of *Cinnamomum Zeylanicum*: cloves, the fruit of ***Eugenia caryophyllata*** (Fig. 500), a beautiful evergreen 15–30 ft. high; and pepper, the fruit of *Piper nigrum*, a short shrub, find a natural habitat in Mindanao and the Sulu group. Spices to the amount of $2,782,301 were imported into the United States in 1899, all of which could be supplied by the Philippines under a proper development of this industry.

GENERAL LIBR

1754. Ylang ylang, yielding a famous oil (× ⅔).

Vanilla, *Vanilla planifolia* (which see), is a climber. It has a long, fleshy pod with numerous seeds, from which are obtained by fermentation the vanilla of commerce. It commences to bear at 3 years old and continues for 30 years or more. In 1899, the value of $1,235,412 was imported into the United States. This plant can be grown luxuriantly on all the Visaya and Sulu islands.

Cocoanut palm, *Cocos nucifera* (Figs. 506, 507, 1497), is an almost universal coast product of these islands. Its certain germination, vigorous growth, number of months in fruitage, and long life without cultivation, give it value in the estimation of the natives. The tree in full bearing produces about 150 nuts annually and continues in fruit nearly the entire year. The fiber of the thick husk enveloping the nut is manufactured into cordage, matting, brushes, bags, etc.; the shell of the nut is made into drinking cups; the kernel or meat of the nut is manufactured into sweetmeats or becomes the copra of commerce; the pint or quart of sweetish liquid in the center of the nut is used for drink, fresh or fermented. For copra, the ripe nuts, after gathering and removing the husk, are allowed to remain in the sun till the milk is dissipated and the kernel shrinks from the shell. The shell is then broken and the meat, further dried, becomes the copra of commerce. This is largely transported as ballast to Europe, where the oil is expressed. In 1897 the export of copra from the Philippines amounted to 113,178,240 lbs., and this amount could be increased indefinitely to meet the demands of trade without trenching upon other products.

Ylang ylang, *Cananga odorata* (Fig. 1754), a native of the Philippines, is a tall tree with large, generally drooping, yellow flowers, from which is obtained the oil of commerce. The average annual export from 1886 to 1890 was $21,937, used by perfumers.

Candlenut or candleberry—the fruit of ***Aleurites triloba***, a tree 30–40 ft. high,—is exported in considerable quantities, averaging about 16,000 lbs. annually. The berry, when dry, burns—hence called candlenut. The oil has the property of drying rapidly, and is used by artists.

Betel-nut, the fruit of the Areca palm, ***Areca Catechu***, is about as large as a hen's egg. When the tough, fibrous shell is removed, a nut about ¾ in. in diameter, having an albuminous rind, remains. This is chewed to aid digestion and sweeten the breath. It is supposed to strengthen the gums. Previous to chewing, it is boiled and wrapped in a betel-leaf with a small quantity of lime. The annual export has not averaged more than 300–400 lbs., mainly to India.

Many fruits, valuable only for home consumption, are produced in the Philippines. The best known of these are bread-fruit, custard apple, mango, mangosteen and mulberry.

Bread fruit, fruit of ***Artocarpus incisa***, is found in all of the principal islands. It is about 6 in. in diameter. When nearly ripe it is gathered and baked. The crust is then removed and the farinaceous pulp is eaten alone or with cocoanut milk. If mashed, packed in a bundle and covered with earth, it undergoes a slight fermentation at first, which soon ceases, and it will then keep for some time. In some islands it is one of the principal foods.

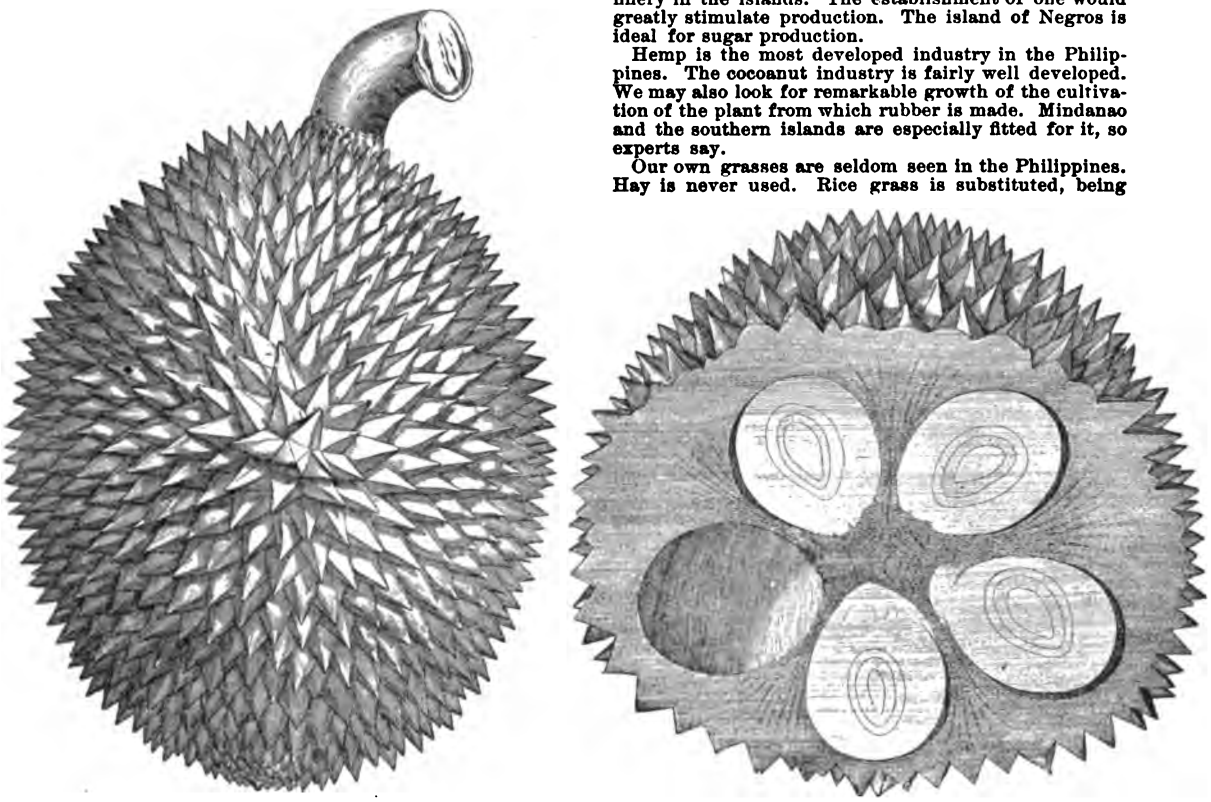
Custard apple, fruit of ***Anona reticulata***, a large, dark brown fruit with a soft, creamy pulp like custard, must be eaten soon after it ripens. This variety was introduced by the Spaniards.

The mango, fruit of ***Mangifera Indica*** (Figs. 1360, 1361), a large, spreading ornamental tree, is about 3 in. long and generally obovate, flattened on one side—light yellow when ripe. The flesh is subacid, rich and juicy, somewhat fibrous, attached to a large stone in the center. There is a slight turpentine flavor, not observed after a taste for the fruit has been acquired. The tree is a constant and prolific bearer, which, with its value and beauty as a shade, makes it a desirable home tree, especially with the better class of people. It is abundant in uncultivated places. The fruit is picked when partially ripe and made into sweet pickles or is preserved, but it is principally eaten in the natural state.

The mangosteen, fruit of ***Garcinia Mangostana*** (Fig. 893), is esteemed the most delicious of the oriental fruits. It is about the size and shape of the apple, with a rind like a pomegranate. The interior is divided by thin partitions into cells, which contain the seeds surrounded by a white or red juicy pulp of a most delicious flavor, combining the finer qualities of the strawberry and the grape. Unfortunately this fruit is too delicate for transportation. In addition to its use as a hand fruit the pulp is preserved or fermented.

The mulberry, both white and black, is grown in Luzon, but it has not attracted the attention which its valuable wood and abundant fruitage warrant.

Tamarind, known as Manila tamarind (fruit of *Pithecolobium dulce*), was introduced from Mexico. The sweetish subacid pulp, inclosing its seed, is boiled and eaten, is made into a cooling drink or is preserved in sugar. The tree is valuable for shade and for timber, and is noted for the fragrance of its flowers.



1755. Fruit of the Durian, exterior view and cross-section. Reduced one-half from a plate of "a middle-sized" specimen.

The sapodilla plum, fruit of the *Achras Sapota* (see *Sapodillo*), a small, somewhat acid fruit, becoming very sweet when overripe, is cultivated to some extent.

The Mammee apple or South American apricot, fruit of *Mammea Americana* (Fig. 1354), is produced in a limited way. The fruit is yellow, 5–6 in. in diam., rind and pulp near the seeds bitter, intermediate portion sweet, aromatic and agreeable.

Grapes can be grown successfully in some of the drier parts of the islands, and there is no doubt of the success of the strawberry and the blackberry in some localities.

Importation of tropical fruits into the United States in 1899, much of which could soon be supplied by the Philippines with proper encouragement:

Coffee	$55,475,470.00
Cocoanuts, copra and figs	5,985,905.00
Bananas	5,665,588.00
Lemons	4,398,004.00
Oranges	1,097,596.00
Spices	2,782,301.00
	$75,204,864.00

S. A. Knapp.

Additional Notes on the Products of the Philippines.—The land in the Philippines is seldom given good attention. Crops are planted in the easiest possible way and allowed to grow about as they will. Plows of a modern make were two years ago unknown there. The natives utilize a crooked limb or a rudely made wooden contrivance to scratch the ground. Probably the production of sugar will be the first to increase under American control. There are only a few *haciendas* or plantations with anything like modern sugar-making machinery. Fully 30 per cent, it is estimated, is lost in the crude processes generally employed. There is no sugar refinery in the islands. The establishment of one would greatly stimulate production. The island of Negros is ideal for sugar production.

Hemp is the most developed industry in the Philippines. The cocoanut industry is fairly well developed. We may also look for remarkable growth of the cultivation of the plant from which rubber is made. Mindanao and the southern islands are especially fitted for it, so experts say.

Our own grasses are seldom seen in the Philippines. Hay is never used. Rice grass is substituted, being harvested in bunches, the sod and soil attached. It is freshened with water before fed to horses and cattle. Spanish books say that cotton is grown to considerable extent in Ilocos provinces of northern Luzon. Strawberries can be found in the higher altitudes of Benguet province. It is said that all efforts to cultivate the rose in the Philippines have failed. More than thirty varieties of bananas are grown in the Philippines, some of which are superior to any in our own markets.

Frank E. Gannett.

Circular No. 17 of the Div. of Bot., U. S. Dept. of Agric., contains 8 pp. of notes on the plant products of the Philippine Islands.

A most remarkable fruit of the Philippines and other parts of Malaya is the durian, shown half size in Fig. 1755 (reduced from plates in vol. 7 of the Trans. of the Linn. Soc., illustrating Charles König's account of the fruit). It is the *Durio zibethinus* of botanists, one of the Malvaceæ. The reader may find an entertaining account of this fruit in Alfred Russel Wallace's "Malay Archipelago," chapter 5. It grows on a "lofty forest tree, somewhat resembling an elm. * * * The fruit is round or slightly oval, about the size of a large cocoanut, of a green color, and covered all over with short stout spines, the bases of which touch each other, and are consequently hexagonal, while the points are very strong and sharp." It has five compartments or cells filled with cream-colored pulp in which are imbedded two or three seeds the size of chestnuts. The liking for the durian is an acquired taste. "To eat durians," writes Wallace, "is a new sensation, worth a voyage to the East to experience."

PHILLYRÈA (its ancient Greek name). *Oleàceæ.* Ornamental evergreen shrubs, with opposite short-petioled, entire or serrate lvs., small white, usually fragrant fls. in axillary clusters and small berry-like, dark-colored fruit. Most species are hardy only South, but *P. decora*, the handsomest of all the species, is probably hardy in sheltered positions as far north as New York. The Phillyreas may be used in the southern states and Calif. for evergreen shrubberies in drier and more exposed localities. They grow in almost any soil and prefer sunny positions; *P. decora* alone seems to grow better if partly shaded. Prop. by seeds and by cuttings of half-ripened wood under glass in summer or by layers; they are also sometimes grafted on *Ligustrum ovalifolium*. Five species in the Mediterranean region. Lvs. entire or serrulate, thick and leathery, quite glabrous: fls. small, in axillary short racemes; calyx 4-toothed; corolla 4-lobed, with short tube; stamens 2, with very short filaments; style shorter than tube: ovary 2-celled· fr a 1-seeded black drupe.

A. *Lvs. ¾–2 in. long: fr. small.*

latifòlia, Linn. Shrub or small tree, to 30 ft., with spreading, somewhat rigid branches: lvs. ovate or oval to ovate-oblong, rounded or slightly cordate at the base, dark green and shining above, pale beneath, ¾–1½ in. long: fr. globose, concave at the apex. May, June. S. Eu., N. Afr. There are several varieties. Var. **lævis**, Ait. Lvs. ovate, almost entire or slightly serrulate. Var. **rotundifòlia**, Arb. Kew. Lvs. broadly ovate or roundish ovate. Var. **spinòsa**, Ait. (*P. ilicifòlia*, Willd.). Lvs. ovate or ovate-oblong, sharply serrate.

mèdia, Linn. Spreading shrub, to 20 ft.: young branchlets puberulous: lvs. oblong-ovate to ovate-lanceolate, entire or serrate, dark green and shining above, ¾–2 in. long: fr. ovoid, pointed. May, June. Mediterranean region.—The most important of the many varieties are the following: Var. **buxifòlia**, Ait., with oblong-ovate, obtusish lvs. Var. **oleæfòlia**, Ait. (*P. oleæfòlia*, Hort.). Lvs. oblong-lanceolate, almost entire; branches erect. Var. **péndula**, Ait. Branches spreading and somewhat pendulous: lvs. lanceolate.

angustifòlia, Linn. Spreading shrub, to 15 ft., with glabrous branchlets: lvs. oblong-lanceolate to linear-lanceolate, dull green above, 1–2 in. long: fr. globose or ovoid-globose, pointed. May, June. Mediterranean region. Var. **rosmarinifòlia**, Ait., has linear-lanceolate lvs., sometimes over 2 in. long, and erect branches. The 3 spreading species are very closely related to each other and considered by some botanists to be varieties of only one species.

AA. *Lvs. 3–5 in. long: fr. ½ in. long.*

décora, Boiss. & Bal. (*P. Vilmoriniàna*, Boiss. & Bal. *P. laurifòlia*, Hort. *P. Medwédewi*, Sred.). Shrub, to 10 ft., with spreading branches: lvs. oblong to oblong-lanceolate, acuminate, usually entire or remotely serrulate, dark green and shining above, yellowish green beneath: fr. oblong-ovoid, purplish black. June, July. W. Asia. B.M. 6800. G.C. III. 4:673; 16:369. R.H. 1889, p. 199; 1895, p. 204, 205. M.D.G. 1898:349. S.H. 2:523. Gn. 24, p. 490.

ALFRED REHDER.

PHILODÉNDRON (Greek compound for *tree-loving*). *Aràceæ.* Shrubby or tree-like, with short internodes, usually climbing, rarely arboreous: leaves from entire to bipinnatifid. Differs from Schismatoglottis in floral characters. The flowers are monœcious, on spadices, with no perianth, the sterile with 2–6 stamens united into a sessile obpyramidal body, the pistillate fls. with a 2–10-loculed ovary and some staminodia, the berries inclosed in the involute spathe. The species are all tropical American. They are monographed by Engler in DC. Phaner. Monogr. 2:355 (1879), and more recently by the same author in Botanische Jahrbücher 26:509 (1899). In the latter, 167 species are accepted

Only a few Philodendrons can be grown to have an ornamental appearance in a small state. One which goes under the name of *P. elegantissimum*, with finely cut leaves, makes a good pot specimen, although it will reach a good height where suitable opportunities are afforded. The same may be said of *P. Selloum*, a beautiful species with pinnatifid leaves. The arborescent kinds should have a very porous rooting medium and copious supplies of water while in active growth. When climbing they must have provision made for the roots, which are produced along the stems. Some of the species do well climbing up the stems of tall palms, such as Arenga and Livistona; otherwise dead trunks of tree ferns make admirable rooting substances for the roots to penetrate and cling to. Propagation is by division of the climbing stems. *P. elegantissimum* is an unidentified trade name.

A. *Leaves bipinnate.*

B. *Terminal leaf-segment 3-lobed, the lobes unequal.*

Sellòum, C. Koch (*P. Séllowi*, Hort.). Blade pinnatisect, the segments again pinnate or lobed; terminal segment 3-lobed, the cuspidate middle lobe about equaling the obtuse lateral ones; spathe slightly cuspidate, its tube longer than the ovate hooded blade, green without, white within. Distinguished from *P. bipinnatifidum* by the very numerous parallel translucent spots, which are visible on both sides of the leaf and are often excurrent on the margin. Brazil to Paraguay.

BB. *Terminal leaf-segment 3–5-lobed, the middle lobe much longer than the lateral ones.*

bipinnatifidum, Schott. Blade pinnatisect, the segments again pinnate or lobed: terminal segment 3–5-lobed, the middle lobe ovate-lanceolate, acute, much longer than the obtuse lateral ones; spathe oblong-ovate, its tube scarcely distinct from its blade, purple without, white within. S. Brazil.

AA. *Leaves simple.*

B. *Leaf-blade lanceolate.*

crassinérvium, Lindl. Climbing: lvs. lanceolate-acuminate, the midnerve very thick and inflated: spathe obtuse and hooded, apiculate at the tip. Brazil. B.R. 23:1958.—*P. nóbile*, Hort., is much like this and perhaps a form of it. It is larger: lvs. obovate-lanceolate: tube of spathe rosy crimson inside and outside, the limb white inside and spotted outside.

BB. *Leaf-blade sagittate.*

speciòsum, Schott. Stem tall, arborescent; petioles terete at the base, concavo-convex above, twice as long as the midrib; blade triangular-oblong-ovate, bright green, acuminate, deeply sagittate, the basal lobes rhomboidal, obtuse, abruptly narrowed on the inner side above the middle; spathes thick, green with purple margins; spadix finger-shaped, shorter than the spathe. Central Brazil.

BBB. *Leaf-blade oblong to ovate-cordate.*

C. *Color of leaf milky white above, with reddish veins.*

Sòdiroi, Hort. Lvs. cordate, ovate, milky white with reddish veins above; petiole cylindrical, pink. U. S. Colombia.

CC. *Color of leaves some shade of green above.*

D. *Petioles tomentose.*

verrucòsum, Mathieu (*P. Càrderi*, Hort.). Stem long, branching, climbing, ashy gray, scabrous, angular-cylindrical, swollen at the nodes; petioles stout cylindrical or somewhat angled, bright metallic red, covered with soft, erect, twisted, fleshy bristles and greenish hairs; blade glabrous, green above, brilliantly polished, or with paler lines and immersed nerves, bright green beneath with salmon-violet lines between the lateral nerves; ovate-cordate, the semicircular basal lobes one-third as long as the slightly undulate apical one. Internodes of the stem 3–6 in. long: petioles 4–6 in.; blades 6–8 in. long, 4–6 in. wide. Venezuelan Andes. I.H. 18:79 (as *P. Daguense*).

DD. *Petioles glabrous.*

gigantèum, Schott. Climbing: petioles 3 ft. long, thick, cylindrical; blade cordate-ovate, 24–28 in. long, 16–20 in. wide, the basal lobes slightly introrse, semi-ovate or obliquely semicircular, one-fourth as long as the apical one, separated by a broad parabolic sinus; spathe tube 2 in. long, oblong, purple; spadix very thick. Trop. America.

Ìmbe, Schott (*P. Sellowianum*, Kunth). Branches rusty purple: petioles of young plant semicylindrical, terete, sparsely brown-spotted, 1⅛–2 times longer than the midrib; blade like parchment, cordate-oblong, the oblong basal lobes one-half as long as the apical, separated by a wide parabolic sinus, retrorse or sub-introrse; apical lobe cuspidate; spathe green outside, red within, its broadly ovate blade dirty yellow; spadix shaped like a finger. Rio de Janeiro.—According to Engler, the Mexican *P. sanguineum* has been called *P. Imbe* in gardens. *P. sanguineum* differs in having more elongated lvs. which are red beneath.

spectábile, Linden. Large, of vigorous habit: lvs. 12–15 in. long, nearly as broad, silky or velvety green. Hab.?

Andreànum, Devans. Lvs. rather large, cordate-ovate, with short basal lobes, bronzy green. Colombia. R.H. 1886:36.—Sparingly grown. Looks like a narrow-lvd. Anthurium.

P. Devansayànum, Lind., is a scandent species with rather small glossy green lvs. which, even to the petioles, are blood-red when young. Peru. I.H. 42:48.—*P. Glaziòvii*, Hook. f., is a climber something like P. crassinervium: lvs. oblong-acute, deep green, 12–18 in. long, 3–5 in. broad: spathe open, yellowish, crimson within the tube. Brazil. B.M. 6813.—*P. imperiàle* is mentioned in European trade lists. Engler accounts for only one P. imperiale (of Schott) and that he makes a synonym of P. asperatum, Koch. Sander & Co. advertise P. imperiale, var. Laucheana: "a lovely trailing stove foliage plant, which is admirably adapted for growing on pillars or wire shapes. It is quite distinct from and greatly superior to the well-known P. imperiale. The habit is much more graceful, the heart-shaped foliage smaller and more elegant. Down the center, from either side of the broad light green midrib, extend irregular blotches of dark green, projecting into a clear glaucous color, the edges of which are relieved by green blotches. The bases of the petioles bear bright red and green phyllodes." P. asperatum is a short-jointed climbing Brazilian species with cordate-ovate entire dull green lvs.—*P. Mámei*. André. Lvs. cordate-ovate, acute, variegated with white: spathe partly open above and whitish, the tube blood-red. Ecuador. R.H. 1883, p. 104; 1883:492; 1897, p. 573. I.H. 43:66.—*P. pertùsum* is Monstera deliciosa.

JARED G. SMITH and G. W. OLIVER.

PHLEBÒDIUM (Greek, *a vein*). *Polypodiàceæ.* A genus of ferns related to *Polypodium* and sometimes united with it, but differing widely in the venation, which is broken up into ample areolæ, each of which contain 2 or more free veinlets which bear the sori on their united tips.

aùreum, R. Br. (*Polypòdium aùreum*, Linn.). Lvs. 2–3 ft. long rising from large, scaly wide-creeping rootstocks; divisions 5–9 in. long, nearly an inch wide, with copious, large, bright yellow sori. A rich ornamental species from tropical America, with glaucous green leaves. In Florida it grows on palmettos.

P. glaùcum, var. *Mayii* or *P. Mayii*. See Phymatodes.

L. M. UNDERWOOD.

PHLÈUM (*phleos*, an old Greek name for a kind of reed). *Gramineæ.* A genus of 10 species in temperate zones. Spikelets 1-fld., in a close cylindrical spike-like panicle: empty glumes 2, persistent, keeled, short-awned: fl.-glume shorter, delicate, awnless. Perennials.

praténse, Linn. TIMOTHY. HERD'S GRASS. Figs. 1756, 1757. Commonly cult. for hay and for pastures, either alone or in company with red clover or other grasses. It was introduced into Maryland about 1720, from Europe, where it is native, by Timothy Hanson, and hence called Timothy. The other name is said to come from a man by the name of Herd, who found it growing in New Hampshire and began its cultivation. It is better adapted for hay than for pasture, and for the latter is suited to temporary rather than permanent pasture.

A. S. HITCHCOCK.

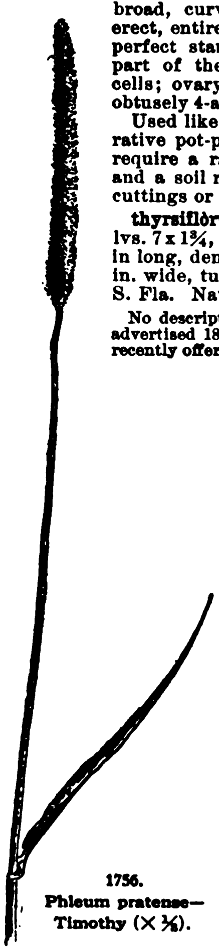
PHLOGACÁNTHUS (Greek for *flame*, and acanthus). *Acanthàceæ.* Tall half-shrubby herbs with entire or somewhat toothed lvs.: fls. white, red or greenish in long terminal or short lateral spikes; calyx 5-parted, segments linear, awnlike, acuminate; corolla-tube long, broad, curved, limb 2-lipped, upper lip erect, entire or 2-lobed; lower lip 3-parted; perfect stamens 2, inserted on the lower part of the tube, anthers with 2 parallel cells; ovary many-ovuled; capsule round or obtusely 4-angled.

Used like the others of the family as decorative pot-plants in the greenhouse. They require a rather warm, damp atmosphere and a soil rich in humus. Propagated by cuttings or seeds.

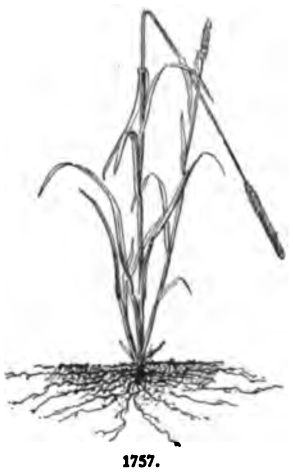
thyrsiflòrus, Nees. Shrub, 3–7 ft. high: lvs. 7 x 1¾, lanceolate, glabrous: fls. orange, in long, dense, villous thryses; corolla ⅝ in. wide, tubular, 2-lipped. India. Cult. in S. Fla. Native to India.

No description is available of *P. cardinalis*, advertised 1893 by Saul, nor of *P. Drummondii*, recently offered by Childs.

HEINRICH HASSELBRING.



1756.
Phleum pratense—
Timothy (X ⅛).



1757.
Phleum pratense—Timothy.
To show habit of root and top.

PHLÒMIS (old Greek name used by Dioscorides). *Labiàtæ.* JERUSALEM SAGE. About 50 species of herbs and shrubs native to the Mediterranean region with dense axillary whorls of rather large yellow, purple or white fls. Perhaps a dozen species have been cult., but they are rather coarse plants except for wild gardening and among shrubbery. They are of the easiest culture. The genus is placed by Bentham and Hooker next to Leonotis (Lion's Ear), which, however, has an excessively long upper lip. Phlomis plants are more or less woolly, and some of the species not cult. in America are conspicuously white-woolly. Lvs. all alike, or the uppermost reduced to bracts: whorls many- or few-fld.: fls. sessile; calyx usually plicate, truncate or with 5 equal teeth; upper lip of the corolla (galea) broad and compressed or strongly concave, rarely narrow and falcate; stamens 4, didynamous. The first three species described below belong to the section Euphlomis, in which the galea (upper lip of the corolla) is only shortly bearded and the lateral lobes of the lower lip are small and appendaged; the last species belongs to the section Phlomidopsis, in which the galea is long-bearded inside and at the margins and the lateral lobes of the lower lip are nearly as large as the middle one. *P. tuberosa* has run wild sparingly in the East. It is a vigorous and hardy species, propagating by subterranean tubers.

A. *Fls. yellow.*

B. *Plants shrubby: bracts not sharp and rigid at the apex.*

C. *Whorls 20–30-fld.*

fruticòsa, Linn. Shrub, 2–4 ft. high, divaricately much-branched: lvs. rounded or wedge-shaped at the base: bracts broadly ovate or ovate-lanceolate. S. Eu. B.M. 1843.—In the East it blooms from June to July. In S. Calif., according to Franceschi, it blooms in winter, and has the merits of withstanding drought and heavy sea winds. In New England it needs protection in winter.

CC. *Whorls about 16-fld.*

viscòsa, Poir. Lvs. truncate or subcordate at the base: bracts lanceolate-linear. Syria. Not in the trade, but inserted to show the differences between this and *P. Russelliana* as recognized by DeCandolle.

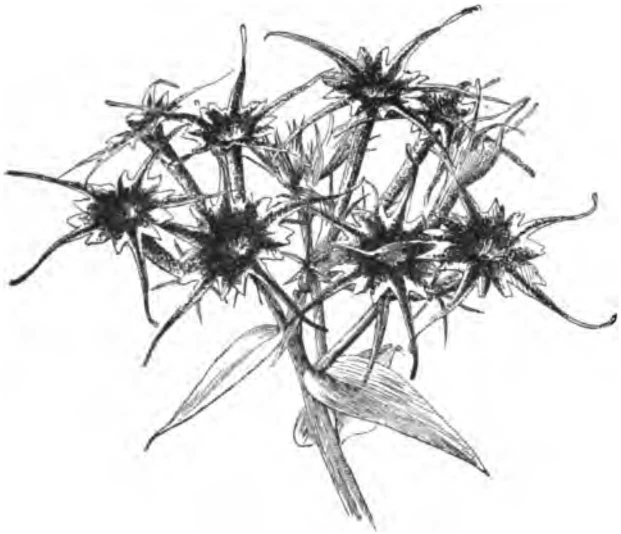
BB. *Plants herbaceous: bracts very sharp and rigid at the apex.*

Russelliàna, Lag. Herb, 3–5 ft. high: lowest lvs. deeply cordate: whorls 40–50-fld. Syria. B.M. 2542 (as *P. lunarifolia*, var. *Russelliana*).

AA. *Fls. purple.*

tuberòsa, Linn. Herb, 3–5 ft. high: lvs. deeply cordate; lowest ones 6 in. or more long; floral lvs. 2–3 in. long, 6–8 lines wide: whorls 30–40-fld. S. Eu., eastern and northern Asia. B.M. 1555.

W. M.



1758. Quedlinburg or Star Phlox.
A horticultural form of *Phlox Drummondii*.
Natural size.

PHLÓX (Greek for *flame*, once applied to species of Lychnis). *Polemoniàceæ*. Phloxes are amongst the most satisfactory of garden plants. Their neat habit, bright-colored flowers, profuseness of bloom, and ease of culture make them favorites everywhere. The Phloxes are herbs, of about 30 species all North American (except perhaps one Chilean), although *P. Sibirica* also grows in Asiatic Russia. There are two classes of Phloxes, the annuals and the perennials. The annuals are derivatives of *Phlox Drummondii*, of Texas, which has now risen to first place as a garden annual. It has been immensely modified by domestication, so that the named garden varieties are numbered by scores. These garden forms differ in stature, color, size and shape of flower. Some are semi-double. An effort has been made to produce a yellow flower, but nothing nearer than a buff has yet been secured. The Phlox colors run to the cyanic series, and it is probable that a pure yellow is unattainable. *Phlox Drummondii* is of the easiest culture. This fact, together with the profusion and long season of its bloom, is an important reason for its popularity. It needs a warm, sunny place. It will grow even in poor soil, but in order to develop to its highest perfection it must have rich soil and the individual plants must be given room (say 1 ft. apart each way). Seeds are usually sown in the open as soon as the weather is settled; sometimes they are sown indoors, but the plants bloom so young that this is rarely practiced. If the ground is poor and dry, the plants usually cease blooming by midsummer, but if plant-food and moisture are abundant they may be expected to continue their bloom until late fall.

The perennial Phloxes comprise many species. *P. paniculata* and *P. maculata* have given rise to the common perennial Phloxes, whereas most of the other species are planted sparingly and have not been greatly modified by domestication. The garden perennial Phlox (of the *P. paniculata* and *P. maculata* type) is amongst the most showy of garden herbs. The terminal panicles have become 1 ft. long in some forms, and as densely filled as a hydrangea. The colors are most frequent in reds, but there are many purple, white, salmon and parti-colored varieties. This perennial Phlox should have a rich and rather moist soil if it is to be grown to perfection. Let each clump have a space, when fully developed, of 2–3 ft. across. The plants as purchased from nurseries usually do not come into full floriferousness until their third or fourth year. They will continue to thrive for several years with little attention, as is attested by the fine clumps of old-fashioned forms about homesteads. For the highest satisfaction in blooms, however, the plants should be relatively young or at least often renewed by dividing the clump. The stool gradually enlarges outwards. From the young, vigorous shoots on the outside of the clump the new plants should be reared, if one desires to propagate the variety to any extent. Old stools should be taken up every year or two, and divided and transplanted. This work is done in the fall, after the growth has ceased. By this process, the plants do not become weak and root-bound. Inferior and vigorous seedlings are often allowed to grow about the old plant, causing the named varieties to "run out." The perennial Phloxes usually bloom in early summer, but if the tips of the shoots are pinched out once or twice in early summer, the bloom may be delayed until late summer or fall.

Phlox is allied to Gilia and Polemonium. Some species are more or less shrubby at the base. The corolla is salverform, the lobes 5 and mostly obtuse, the throat narrow or nearly closed. The stamens are 5 and inserted on the corolla-tube, the anthers usually included in the tube. The fruit is a small capsule with 3 locules and few to several small usually flattish seeds. Leaves mostly opposite (upper ones sometimes alternate), entire. See Gray, Syn. Fl. vol. ii, pt. 1, p. 129.

INDEX.

acuminata, 2.
adsurgens, 14.
alba, 12.
amœna, 8.
aristata, 9, 12.
bifida, 10.
Canadensis, 6.
Carolina, 4.
carnea, 5.
decussata, 2.
divaricata, 6.
Douglasii, 13.
Drummondii, 1.
frondosa, 12.
glaberrima, 5.
grandiflora, 1.
Heynoldiana, 1.
hortensiæflora, 1.
Leopoldii. 1.
maculata 3.
nana, 16.
Nelsoni, 12.
nitida, 5.
nivalis, 12.
omniflora is an old garden name of some hybrid Phlox of the P. paniculata section.
ovata, 4.
paniculata, 2.
pilosa, 9.
procumbens, 8.
reptans, 7.
setacea, 12.
speciosa, 15.
Stellaria, 11.
stellata, 1.
stolonifera, 7.
subulata, 12.
suffruticosa, 5.
triflora, 4.

A. *Annual garden Phlox, pubescent, upper lvs. often alternate.*

1. **Drúmmondii,** Hook. Figs. 1758–60. Erect, branching, 6–18 in. tall: lvs. oblong-acute or lanceolate, the upper ones more or less clasping: fls. showy, in broad mostly flat-topped cymes, the calyx-lobes long and narrow and spreading or recurving in fruit, the corolla-lobes broad-obovate. Texas. B.M. 3441. B.R. 23:1949.—This is the common annual garden Phlox, now cultivated in numerous varieties, some of them having deeply cut petals (the "star" Phloxes). Fig. 1758. The seeds were received in England in the spring of 1835,

from Texas, having been collected by Drummond. In October of that year it was described and figured in Botanical Magazine, by W. J. Hooker, as *Phlox Drummondii*. The flower was described as "pale purple without, within, or on the upper side, of a brilliant rose-red or purple, varying exceedingly on different individuals in intensity, and in their more or less red or purple tinge, the eye generally of an exceedingly deep crimson." Lindley described and figured it in Botanical Register, 1837, describing the flowers as "either light or deep carmine on the inner surface of their corolla, and a pale blush on the outside, which sets off wonderfully the general effect. A bed of this plant has hardly yet been seen; for it is far too precious and uncommon to be possessed by any one, except in small quantities; but I have had such a bed described to me, and I can readily believe that it produced all the brilliancy that my informant represented." At the present time, *Phlox Drummondii* is one of the most popular annuals, and it has varied into many shades. *P. hortensiæflora*, *P. stellata*, *P. Leopoldii*, *P. grandiflora*, *P. Heynoldiana*, and many other names, belong here.

AA. *Perennial Phloxes of various habit, either pubescent or glabrous.*

B. *Flowering stems erect and usually stiffish.*

C. *Plant glabrous (exceptions in var. of No. 5).*

D. *Inflorescence large and thyrse-like: plants tall.*

2. **paniculàta**, Linn. (*P. decussàta*, Hort.). Fig. 1761. PERENNIAL PHLOX of gardens, in many forms. Plant stout and erect, 2–4 ft., glabrous: lvs. oblong-lanceolate and mostly tapering at the base: calyx-teeth awl-like. Woods, Pa., W. and S. B.M. 1880 (as *P. acuminata*).—The parent of the great number of perennial Phloxes of gardens, although some of these may be hybrids with the next. "Fls. pink-purple, varying to white," according to Gray. In cult. varying much in color.

3. **maculàta**, Linn. Slenderer, usually with a spotted stem: lvs. very smooth and usually thicker than those of tne above, the upper ones usually clasping: calyx-teeth short: fls. as in above. Range of the last, and in cult., but less important horticulturally than *P. paniculata*

1759. Phlox Drummondii. (× ½.)

1760. Phlox Drummondii. (× ⅓.)

DD. *Inflorescence small and loose or flat-topped: plants lower.*

4. **ovàta**, Linn. (*P. Carolìna*, Linn. *P. triflòra*, Sweet). A foot or two tall, the stems erect from a short, decumbent base: lvs. narrow-ovate to oblong-lanceolate, the lower ones tapering to base and the upper ones somewhat clasping: fls. pink or light red, about 1 in. across, the straight or slightly curving tube twice or more longer than the rather short and broad calyx-teeth. Pa., south, mostly in elevated regions. B.M. 528.

1761. Phlox paniculata.

5. **glabérrima**, Linn. Fig. 1762. Differs in somewhat taller growth, linear-lanceolate to narrow-lanceolate, taper-pointed, firm, nearly veinless lvs. which have revolute margins, and in the narrow, very sharp-pointed calyx-teeth. Va. to Wis., and south.

Var. **suffruticòsa**, Gray (*P. suffruticòsa*, Willd. *P. nítida*, Pursh). Stiffer, sometimes pubescent above: lvs. considerably broader: fls. varying to flesh color. Ga. and Tenn., south and west. B.M. 2155 (as *P. carnea*). B.R. 1:68.

CC. *Plant distinctly hairy or pubescent (exceptions in No. 9).*

D. *Sterile, prostrate or running shoots arising from the base of the plant.*

6. **divaricàta**, Linn. (*P. Canadénsis*, Sweet). WILD SWEET WILLIAM. Stems slender, pubescent, 10–18 in. tall: lvs. varying from linear-oblong to ovate-lanceolate, mostly acute: fls. in small cymes terminating short branches, 1 in. across, blue or pinkish blue, handsome and somewhat fragrant, the corolla-lobes often notched, the calyx-lobes narrow and subulate. Woods and copses, in lowish grounds western Ontario, west and south. B.M. 163. G.F. 7:256.—A very attractive early spring flower, often coloring the fields in Michigan and other parts. Prefers rich soil.

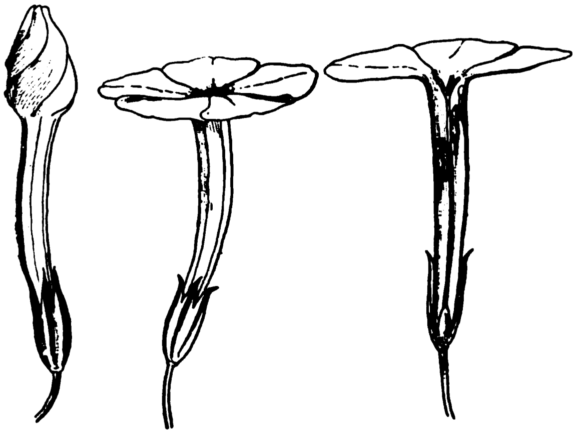
7. **réptans**, Michx. (*P. stolonífera*, Sims). Low and weak, the flowering stems reaching 6–12 in., the sterile ones long and prostrate, the plant thinly glandular-hairy: lvs. short-ovate or obovate, more or less obtuse: fls. few in each cyme, purple or violet, the lobes mostly entire, the calyx-lobes narrow and subulate. Pa. and Ky. to Ga., mostly in the upper regions. B.M. 563.

DD. *Sterile prostrate shoots none.*

8. **amœna**, Sims (*P. procúmbens*, Gray). Stems 6 in. or less high from a decumbent base, pubescent or hairy: lvs. numerous, mostly in rosettes at the base, few on

the flowering stems, small, oblong-lanceolate to linear-oblong, mostly obtuse but sometimes nearly or quite acute: fls. numerous for the size of the plant, purple, pink or white, the lobes usually entire, the calyx-lobes narrow and sharp-acute. Dry lands, Va. to Ky. and south. B.M. 1308.

9. **pilòsa,** Linn. (*P. aristàta,* Michx.). Stems slender but erect, 2 ft. or less tall, pubescent or hairy (nearly glabrous forms occur): lvs. small, linear or linear-lanceolate, widest near the base, acuminate: fls. numerous in rather loose cymes, varying through purple, pink and white, the lobes entire, the calyx-lobes awn-like. Dry fields, woods and prairies, British Amer. to Fla. and Tex., growing as far east as New Jersey. B.M. 1307. L.B.C. 13:1251.



1762. Phlox glaberrima (X 1¼).

BB. *Flowering stems diffuse and branching, often creeping, low: plants of more or less tufted habit.*

C. *Corolla-lobes 4-parted or very strongly notched.*

10. **bífida,** Beck. Low, the stems stiff and sometimes almost woody and often 1 ft. long and rising 3–8 in. from the ground, minutely pubescent: lvs. linear and rigid, 2 in. or less long: fls. scattered, violet-purple, the lobes 2- or 3-cleft as far as the middle or farther into narrow spreading segments. Prairies, Ill. and Mo.—Rarely cultivated.

11. **Stellària,** Gray. Glabrous: lvs. linear, sparingly ciliate towards the base: fls. scattered, usually long-peduncled, pale blue to whitish, the lobes cleft only at the apex into short oblong parts. Lexington, Ky., to southern Ill. G.F. 1:257.

CC. *Corolla-lobes very shallow-notched or entire.*

D. *Peduncles usually bearing few to several slender-pedicelled fls.*

12. **subulàta,** Linn. (*P.nivàlis,* Lodd.). GROUND PINK. MOSS PINK. Fig. 1763. Tufted or matted, the depressed stems more or less pubescent: lvs. crowded or fascicled (except on the flowering stems), narrow-linear to linear-lanceolate, very sharp and usually stiff, ciliate: fls. nearly 1 in. across, light blue, pink or white, in small clusters standing 2–6 in. above the ground, the lobes obcordate or entire. Dry banks and fields, New York W. and S. B.M. 411; 415 (as *P. setacea*). L.B.C. 8:780; 18:1731 (as *P. aristata*).—A much prized old garden plant, useful for colonizing where it is desired to cover the earth with a mat. It is much used in cemeteries. It blooms profusely in spring. The plant is very variable. *P. Nelsoni,* Hort., and *P. nivalis,* Lodd., are white-fld. forms. Var. **álba** is a common white form. There are striped forms. Var. **frondòsa** is a vigorous garden form with rose-colored fls.

DD. *Peduncles chiefly axillary and mostly 1- to 3-fld., or the fls. nearly sessile.*

E. *Lvs. crowded or fascicled: plant forming a dense evergreen mat or tuft.*

13. **Doùglasii,** Hook. Very low and densely tufted, pubescent or nearly glabrous: lvs. very narrow, pointed, the margins at base often ciliate: fls. small and short-stalked, purple, lilac or white, about ½ in. across, the lobes obovate and entire, the tube little exceeding the calyx. Utah and Mont., W.

EE. *Lvs. little if at all fascicled: plant only loosely tufted*

F. *Style nearly or quite equaling the corolla-tube.*

14. **adsúrgens,** Torr. Stems 3–6 in. long, diffuse and ascending, glabrous except the peduncles and calyx: lvs. ovate-lanceolate or ovate, acute, less than 1 in. long: fls. rose-colored or whitish, nearly or quite 1 in. across, the obovate lobes entire, the tube nearly twice longer than calyx. Oregon. G.F. 1:66.

FF. *Style very short.*

15. **speciòsa,** Pursh. Variable in size, sometimes ascending to 3 ft., more or less glandular above: lvs. 2 in. or less long, linear to lanceolate, the uppermost broad at base: fls. rose-pink or whitish, in corymbs, the lobes obcordate, the tube little surpassing the calyx. Calif., north.

16. **nàna,** Nutt. Only a few inches high, glandular-pubescent: lvs. 2 in. or less long, linear, sometimes alternate: fls. light red or rose to white, scattered or somewhat corymbose, about 1 in. across, the lobes usually entire and roundish, the tube somewhat surpassing the calyx. Colo., New Mex., Tex. G.F. 1:413.

L. H. B.

PHŒNICOPHÒRIUM Sechellarum. See *Stevensonia grandifolia.*

PHŒ̀NIX (Theophrastus gave this name to the Date-palm, perhaps thinking of Phœnicia, where the Greeks were supposed first to have seen it, or of the Phœnician purple, or of the fabled bird of Egypt). *Palmàceæ.* An exceedingly distinct and popular genus of palms, whose horticultural merits are discussed below.

Spineless palms, without trunks, or with stout or slender, short or long, often cespitose erect or inclined trunks, clothed above with the persistent bases of the leaves: lvs. terminal, spreading, recurved, unequally pinnate; segments somewhat fasciculate or almost equidistant, elongated-lanceolate or ensiform, acuminate, rigid, inserted by the wide base; margins entire or folded in their entire length; rachis laterally compressed, convex on the back; petiole plano-convex, usually spiny, with very short rigid pinnæ; sheaths short, fibrous: spadices usually many, erect or nodding in fruit, or pendent: peduncle strongly compressed: branches usually somewhat umbellate: spathe basilar, entire, long, compressed, 2-edged, coriaceous, ventrally

1763. Phlox subulata, or Moss Pink.

and at length dorsally divided; bracts usually obsolete: fls. yellow: fr. a berry or drupe, oblong, orange, brown or black Species 10 to 12, perhaps more. Tropical and subtropical Asia and Africa.

JARED G. SMITH.

Phœnix in General.—The latest botanical monograph of Phœnix (by Beccari in Malesia 3:345) admits only 10 species, although there are about 60 names. Such a "lumping" of species is very unwelcome to the horticulturist, and it is probable that nearly all the synonyms cited below represent forms that are abundantly distinct for horticultural purposes.

A good horticultural appreciation of Phœnix is that by William Watson, of Kew, in G.C. III. 9:234, 298, from which liberal extracts are made below. Phœnixes differ from all other pinnate-leaved palms in having the lvs. folded upwards and lengthwise, and in the peculiar form of the seed, as seen in the Date stone. The plants are either male or female. The fruits of only one species are used for food; viz., *P. dactylifera.* (For Date culture, see *Date.*) In England only *P. rupicola* ranks among popular decorative plants. Of all palms, the cultivated species of Phœnix are the most difficult to define. Many hybrids have been raised in the gardens of the Riviera, where many species flower and fruit every year. It is almost impossible to keep these pure. Kerchove records the wonderful fecundity of a Phœnix; *P. reclinata* at Nice fertilized with pollen from *P. tenuis, reclinata* and *pumila* produced 20,000 seeds. The raising of Phœnixes from seed is done on a large scale on the Riviera. The seeds are sown in beds in the open and the seedlings transplanted into shallow trenches, like celery, so that the trenches may be regularly flooded during the summer drought. Watson thinks that next to the coco-palm, the Date is perhaps the most useful tree in the world.

P. Canariensis is the noblest of all Phœnixes, and one of the most majestic palms in cultivation. Its rate of growth is astonishing: a tree supposed to be only 10 years old had a trunk 4 feet high, 3 feet in diam. at the base, with about 100 lvs. forming a head 25 feet across. Another specimen of about the same size bore 8 bunches of fruit, each weighing about 50 lbs.

P. sylvestris is the Wild Date of India, where it is cultivated for its sap, which yields sugar and "toddy." The trunk attains a height of about 4 feet when 7 years old, and it is then tapped by cutting a notch in the stem at the top and catching the sap as it runs out. The tree continues to yield annually 15–18 gallons of sap for 20–25 years, or 8 lbs. of sugar per year. Fifty thousand tons of date-sugar are produced every year in Bengal alone from this and other palms.

"*P. reclinata* and *P. spinosa* are united under the former name by Beccari. Taking the dwarf, cespitose, shiny-leaved elegant plant found in Caffraria as far south as Grahamstown, and comparing it with the tall, solitary-stemmed, huge-headed, gray-green-leaved plant of the tropical regions of Africa, it is difficult to believe that they are merely forms of one species."

The following are grown at Kew in greenhouse temperature (others require stove treatment): *P. Canariensis, dactylifera, humilis* and var. *Hanceana, intermedia, reclinata* and *spinosa.*

The most interesting novelty in Phœnix during the last decade is *P. Rœbelenii,* the pygmy Phœnix. Fig. 1765. Specimens 20–30 yrs. old have stems not over 2 ft. high. Watson says: "It is by far the smallest of all the many kinds of Phœnix known, and is also exceptional in the form of its stem and in the elegance and soft texture of its bright green leaves." Watson adds that it deserves to rank with *Cocos Weddelliana* and *Geonoma gracilis* for usefulness in a small state. This palm suckers freely and in a wild state grows in clumps. Out of deference to the latest monographer, *P. Rœbelenii* is here treated as a variety of *P. humilis;* but Watson declares that it is a distinct species and that in the form and texture of its lvs. it resembles *P. rupicola* more than any other species.

W. M.

Phœnix in Florida.—No palms in the writer's Florida garden can vie in beauty, stateliness, and massive growth with some of the members of the genus Phœnix. The undersigned cultivates specimens of all the kinds offered by the trade. All the palms for this Florida garden, with a few exceptions, have been raised during the last ten years from seed in the writer's greenhouse in Milwaukee. Most of them, although planted on high and dry sandy pineland, begin to show an elegance, stateliness and beauty entirely beyond all expectations, especially the species of Sabal and hardy Cocos, but the Phœnixes are far ahead of them all. As soon as the seedlings began to show their characteristic leaves they were sent to Florida. The first ones were set out in the fall of 1891. Of these Phœnixes several have attained a height of 10–15 ft. and a spread of lvs. 15–25 ft. in diam. The massive trunks are almost as thick as a water barrel

1764. Date Palm—Phœnix dactylifera.
An unusually straight-trunked specimen.

and the height above the ground is 4–5 ft., while at least 3 feet more are buried in the ground like a post to keep the exceedingly heavy top in position. The trunk all around and up from the ground is provided with strong lvs. 10–15 ft. long. In the lower extremity of each frond the leaflets are replaced by long formidable spines, which perhaps serve the purpose of protecting the trunk and the earth of the plant from the attacks of man and beast.

The type of the genus, the common Date-palm, *Phœnix dactylifera*, is the least ornamental of all, and its growth is disappointingly slow. The writer has seen a plant 16 years old which just now begins to form a trunk. Well-grown specimens are very fine, but they cannot be considered rivals in beauty of the four kinds which are the subjects of the four following paragraphs. *Phœnix dactylifera*, var. *excelsa*, is much more robust and rapid-growing than the typical Date.

The East Indian Wild Date, *Phœnix sylvestris*, though having the same glaucous foliage as the common species, is a rapid grower and an exceedingly beautiful and stately palm. The writer has seen specimens 12 years from the seed that had assumed a height of 25 ft., with lvs. 12–15 ft. long and a spread of the crown 25–30 ft. in diameter. It is perfectly hardy, having stood a frost of 15° above zero, and it grows equally well on high and low land, though its growth is much quicker in fairly moist soil.

The stateliest of all the palms that can be grown in the gardens of Florida is the Canary Island Date, *Phœnix Canariensis*, a species with huge trunk and immense lvs. 12–15 ft. long, with a spread of the crown averaging 30 ft. in diameter. The leaflets, which are densely set along the midrid of the frond, are flattened and are of a glossy dark green color. At an age of 8 or 10 years this species begins to form a trunk and to show its true character. The trunk is now about 3 feet in diameter and its massiveness reminds one of a water barrel. At an age of about 12–15 years this palm is a grand and noble object, a perfect picture of symmetrical beauty. There is no palm in the Florida gardens that can compare with it in stateliness and grandeur and in rapidity of growth. Its beauty is much enhanced if planted in groups or if arranged with specimens of Sabals and Cocos and the grand *Bambusa argentea*. Landscape effects can be obtained in this way that will be not only unique but at the same time enchantingly beautiful.

Perhaps of equal beauty and almost of the same stateliness and vigorous growth is a hybrid said to have been raised by the late E. H. Hart, between *P. Canariensis* and *P. sylvestris*. It has the beautiful glaucous color of the latter and the flattened leaflets as well as the sturdy growth of the former. A plant received by the writer in the fall of 1891 is now 13 ft. high, with a diam. of the trunk of 3 ft. The lower leaves, which almost rest on the ground, are over 12 ft. long, while the upper ones gracefully arch to all sides. Most of the writer's visitors from the North pronounce this the most beautiful of all his palms. It is indeed a grand and beautiful plant.

Another palm of great beauty is *P. tenuis*. It is similar to the Canary Island Date, but it has a more slender trunk and narrower and more arching leaves, which have a much lighter green color. It is of a very strong growth and soon forms fine specimens. This species belongs to the group of large-growing kinds forming a single stem. They produce no suckers at the base of the trunk to speak of. Most of the other kinds are smaller, more tender, bushy, and produce suckers freely.

According to Drude, in "Die Natürlichen Pflanzenfamilien," there are only about eleven good species of Phœnix, but there is no doubt that the limits of the various species are at present not well understood, and considerable confusion prevails among the synonyms. *P. Leonensis* and *P. spinosa* are apparently not to be separated, the latter being perhaps a synonym. The glossy green lvs. are provided on their edges with soft white threads. It is a strong-growing palm with long and slender lvs., and, as suckers are pushed up profusely, it soon forms dense clumps of great beauty which eventually attain a height of 15–18 feet. *P. reclinata*, with arching leaves, perhaps never grows higher than 10–12 ft. It is a bushy palm of a glossy dark green color. *P. Natalensis* and *P. Zanzibarensis* seem to be identical with *P. reclinata*. *P. farinifera* is a low bushy palm of great elegance from East India, and *P. rupicola* and *P. cycadifolia* are also very graceful and fine species. The latter species has the most beautiful and elegant foliage of all the species of Phœnix. *P. pumila* and *P. acaulis* are very small kinds, while *P. paludosa*, being provided along the leaves around the stem with formidable spines, forms dense and impenetrable thickets. *P. glauca* is a small-growing species with glaucous-green foliage. These are all tender palms, but they grow well on high pineland.

1765. Phœnix Rœbelenii of horticulturists, but considered by botanists to be a form of *P. humilis*. See species No. 6, on p. 1311.

All these Date-palms grow with great luxuriance in south Florida; but *P. Canariensis*, *P. sylvestris*, *P. tenuis* and the hybrid between *P. Canariensis* and *P. sylvestris* are not only the hardiest and the most beautiful of all but they form extremely elegant and stately specimens in about ten years from the time of planting. They grow most luxuriantly in low, moist, rich soil, but they also do exceedingly well on high pineland if well fertilized during the rainy season. In fact, they will thrive under an application of nitrogenous fertilizers in quantities sufficient to kill almost any other plant. The lower leaves of *P. Canariensis* often suffer from rusty spots which disfigure them badly, but the spots will soon disappear if the plants are well watered, cultivated, and fertilized.

All the members of the bushy-growing group of Date-palms are rather tender, and they have suffered severely by the heavy freezes which have visited Florida of late years. Though losing all their foliage, they will be as fine as ever the next fall if, immediately following the frost, the heart-leaf is pulled out. If left in its position it will soon rot and injure the center of the plant beyond recovery.

Deep planting is very essential with all palms, but especially with the large and massive Dates. Each plant should be set in a basin-like excavation about 6–8 ft. in diam. and 2 ft. deep in the center. If this precaution is not taken the heavy palm would very likely be blown over by strong winds. The young palm after planting works its way down until it stands about 2½–3 ft. deep in the soil; then the trunk grows upward. There it stands like a post, smoothly rounded at the bottom, emerging its long, rope-like roots in all directions but particularly downward. The writer knows of a specimen in which the ends of the roots at a depth of 15 ft. could not be found and they evidently went down many more feet until they had reached the clay-bank or the water. There are quite a number of small feeding-roots found in dense masses all along the rope-like main-roots near the surface of the soil, but not such a network of surface-roots as we find in all the hardy species of Cocos (of the *C. australis* type), in which almost all the roots run horizontal and are mostly found near the surface, while in the species of Phœnix they run downward. The large-growing species flower profusely in the fall and winter, while the bushy species all flower during the spring months. In all the species of Phœnix the male and female flowers are borne on different individuals, and the various species flowering at the same time hybridize readily. H. NEHRLING.

Phœnix in California.—The undersigned now has growing in the ground the following species: *P. Canariensis, dactylifera, reclinata.* all large; *cycadifolia, farinifera, pumila, rupicola, tenuis,* 2–4 ft. high; *Hanceana, Jubæ, sylvestris* and *Zeylanica*, all in pots. Much confusion exists here, and few dare recognize more than the three first named. We have *P. dactylifera* as high as 100 ft. Some specimens grown from seed saved from commercial dates have made 50 ft. of trunk in 30 years, while others of the same seeding have made but 8 ft. Either we have numerous hybrids here or else some species that no one knows. We have them in all shades of green and glaucous-green, all habits of growth, stiff and upright, pendulous and soft, narrow leaves and broad ones, slim-folded and wide-spreading, the latter like an inverted leaf of *Jubæa spectabilis.* No one here has attempted to straighten them out. The only species easily recognized everywhere and by every one is *P. Canariensis*, the gem of the genus. This is regarded by one eminent Californian nurseryman as a garden hybrid, but it always produces fertile seeds, and seedlings from it do not vary, which cannot be said of any other Phœnix here. Next in popularity comes *P. reclinata;* the others are only found in collections. *P. dactylifera* is seldom planted now, and few nurseries ever grow it. All species of Phœnix are hardy here as far as the writer knows. *P. Canariensis* is most easily removed from the ground, and the best time is Aug. and Sept., the hottest weather, as then they recuperate faster. The only other time to remove is in the early spring, before growth, and then if the weather turns cold it is risky. ERNEST BRAUNTON.

Phœnix in the North.—Although Phœnixes cannot be considered to be as decorative subjects as the Howeas and Chrysalidocarpus, they are among the hardiest of palms. For any unfavorable situation where any palm can be expected to thrive, recommend a Phœnix. Outdoors they endure the hottest sunshine without losing a particle of color, whether placed in jars, vases or beds. As house plants they are unequaled for resistance to neglect. They also bear the tying and untying and the crowding and wear and tear of public decorative work better than any other palms. The writer has a pair of specimens of *Phœnix rupicola*, which within the past six years have been packed and unpacked five hundred times; they have withstood excessive heat and cold, gas and dust, and still stand to-day in the broad sun with their arching fronds perfect. The Date-palm is not quite so graceful. *P. Leonensis* or *spinosa* is slightly stiffer than *P. rupicola*, but very handsome. Other kinds useful to the florist are *P. Canariensis, farinifera, pumila* and *tenuis.* (This paragraph has been adapted from an article in Scott's Florists' Manual which embodies the experience of Mr. Scott and of the undersigned.) W. H. TAPLIN.

INDEX.

(Various other names will be found in horticultural literature, but the following comprise those known to the American trade.)

acaulis, 7.
Andersoni, 1.
Canariensis, 9.
cycadifolia, 11.
dactylifera, 11.
excelsa, 11.
farinifera, 4.
Hanceana, 6.
humilis, 6.
Jubæ, 9.
Leonensis, 2.
Lourierii, 6.
macrocarpa, 9.
melanocarpa, 2.
paludosa, 3.
pumila, 8.
pusilla, 5.
reclinata, 2.
Rœbelenii, 6.
rupicola, 1.
Senegalensis, 2.
spinosa, 2.
sylvestris, 10.
tenuis, 9.
Zanzibarensis, 2.
Zeylanica, 5.

A. *Texture of lfts. flaccid*.............. 1. **rupicola**
AA. *Texture of lfts. rigid.*
B. *Arrangement of lfts. 2-ranked.*
C. *Form of lfts. lanceolate*........ 2. **reclinata**
CC. *Form of lfts. ensiform, with filiform tips*.................. 3. **paludosa**
BB. *Arrangement of lfts. 2–4 or many-ranked.*
C. *Position of lfts. equidistant.*
D. *Color of lvs. dark green*..... 4. **farinifera**
DD. *Color of lvs. light green*..... 5. **pusilla**
CC. *Position of lfts. grouped or fascicled.*
D. *Stem bulbiform: lvs. short.*
E. *Lfts. scattered, irregularly fascicled*................ 6. **humilis**
EE. *Lfts. in nearly opposite fascicles*................ 7. **acaulis**
DD. *Stem erect: lvs. long.*
E. *Lvs. very slender*......... 8. **pumila**
9. **Canariensis**
EE. *Lvs. more robust.*
F. *Foliage glabrous*.......10. **sylvestris**
FF. *Foliage glaucous*.......11. **dactylifera**

1. **rupicola**, T. Anders. (*P. Andersoni*, Hort. Calcutta). Stem 15–20 ft. x 8 in., solitary, slender, naked: lvs. 10 ft., quite glabrous; petiole compressed; segments 1⅓ ft., 2-ranked, not fascicled, flaccid, bright green. Sikkim, Himalaya. G.C. II. 8:45. F. 1887, p. 165. I.H. 25:318. F.R. 1:143. A.G. 13:141. A.F. 4:569.—"The numerous bright green decurved lfts. all in one plane are peculiar to this beautiful species." A form with some of the lfts. white is figured in I.H 34:3.

2. **reclinàta**, Jacq. (*P. Leonénsis*, Lodd. *P. Senegalénsis*, Van Houtte. *P. spinòsa*, Schum. & Thom. *P. Zanzibarénsis*, Hort.). Stem short (3–4 ft.): lvs. 2-ranked, bright green, obliquely arcuate-recurved toward the apex; lfts. rigid, approximate, strict, 12 in. long, 1 in. wide, lanceolate, acuminate, pungent, the terminal 9 in. long, slightly bifid, the lowest spinescent. Trop. and S. Africa. F. 1871, p. 135. A.F. 4:568. A.G. 13:141; 14:410; 16:346. Gn. 39, p. 140.—*P. melanocárpa*, Naud., has black edible fruits, and was found in a garden at Nice. It is "supposed to be a variety of *P. Senegalensis*." R.H. 1894, pp. 493, 496, 497.

3. **paludòsa**, Roxb. Gregarious, subarboreous: trunks 8–25 ft. high, 12–18 in. in diam., often reclining, annulate: lvs. 8–10 ft.; lfts. 1–2 ft., opposite and alternate, 2-ranked, ensiform, with filiform tips, whitish or mealy beneath; petiole 3–5 ft. long, slender, scurfy, with many long spines; sheath fibrous: fr. black-purple. Seashore, tropical Asia.

4. **farinifera**, Roxb. Shrubby: caudex at most 4 ft., thickly clothed with old leaf-sheaths: petiole with 1 or 2 pairs of spines; lfts. subopposite, 4-ranked, ensiform, rigid, pungent, dark green: fr. black. Ceylon and southern India.—"The caudex has a farinaceous pith" (Roxb.). "The foliage is so spiny that it is impossible to walk through clumps of it" (Steavenson).

5. **pusilla**, Gærtn. (*P. Zeylánica*, Hort.). Stem 10–14 ft.: lvs. rather short; lfts. very many, subequidistant, 7–10 in., spreading at right angles, 4-ranked, rigid, pungent, bright green. Ceylon.

6. **hùmilis**, Royle. Stems short, tufted, bulbiform, rarely elongated: lvs. subglaucous; lfts. scattered, interruptedly fascicled. Very close to *P. acaulis*, but distinguished by the very long-peduncled, fruiting spadix. Hilly districts of India.—Var. **Hanceàna**, Becc. (*P. Hanceàna*, Hort.), from China, is cultivated.

Var. **Lourièrii**, Becc. (*P. Rœbelenii*, O'Brien). Fig. 1765. Lvs. 1 ft. long; lfts. 5–7 in. long, shining, dark green, soft, curved, subglaucous, often approximate, mostly falcate, not spinous at the tip. Assam to Cochin China. G.M. 38:80. A.G. 15:201. G.C. III. 6:475; 11:731. G.F. 3:273.

7. **acaùlis**, Buch. Caudex bulbiform, 8–10 in. in diam., densely clothed with sheaths and bases of the petioles: lvs. 2–6 ft.; lfts. in subopposite fascicles, many-ranked, ½–1½ ft. long, very rigid, somewhat glaucous, marginal nerve very strong; petiole 1 ft. or more, with many spines: fr. bright red to blue-black. India.

8. **pùmila,** Hort. Stem slender, graceful. 6–10 ft.: lvs. 10–16 ft. long, recurved, drooping; lfts. 8–12 in. long, 4-ranked. Gt. 20, p. 173 (description). Fla. Farm. & Fr. Gr. 1898:67.

9. **Canariénsis,** Hort. (*P. ténuis*, Versch. *P. Jùbæ*, Webb). Resembling *P. dactylifera*, but more slender and graceful in all its parts: lvs. more numerous. Canary Islands. R.H. 1888:181. G.C. III. 15:405. V. 19:51. Gng. 5:215. Gn. 57, p. 255. R.H. 1893, pp. 126, 127.—Var. **macrocárpa** is cult. in Florida.

10. **sylvéstris,** Roxb. Stem solitary, stout. 25–40 ft. high, clothed with persistent petiole bases: lvs. 10–15 ft., glabrous; petiole spiny; segments 1–2 ft., fascicled, 2–4-ranked, rigid, light green. Very close to *P. dactylifera* and perhaps the origin of that plant. India. I.H. 10:351. V. 16:101. F. 1872, p. 29. Gn. 54, p. 117. G.C. III. 10:105.—A hybrid of *P. sylvestris* and *Canariensis* secured by E. H. Hart is highly praised by American connoisseurs.

11. **dactylifera,** Linn. (*P. cycadifòlia*. Hort.). DATE-PALM. Fig. 1764. Stem tall, erect: lvs. glaucous, arcuate-ascending; lfts. linear-lanceolate acuminate, strongly complicate, the lower 4-ranked, the upper 2-ranked, irregularly and remotely aggregate: fr. cylindrical-elliptical, 1–2 in. long. Arabia, N. Afr. R.H. 1893, p. 127.—Var. **excélsa** is cult. in Florida. See *Date*.

P. dumòsa, Hort. Saul, 1893. Of "dwarf habit." Seems unknown to botanists.—*P. glaùca*, cult. by H. Nehrling, is a name not in the texts.—*P. Natalénsis* and var. variegata are offered by Reasoner, but no description is available.—*P. Sanderiàna*. Presumably introduced within recent years by Sander & Co., St. Albans, Eng.—*P. spinulòsa*, Hort. Saul, 1893, is an obscure name.—*P. tomentòsa*, cult. by H. Nehrling, is an obscure name.

JARED G. SMITH.

1766. American mistletoe—Phoradendron flavescens. (×⅛.)

PHOLIDÒTA (Greek, *scale* and *ear;* the scales of the unopened raceme are said to recall the rattle of a snake). *Orchidàceæ*. A small genus containing about 20 species, natives of India, S. China and the Malay Archipelago. Mostly of the habit of Cœlogyne, with creeping rhizomes and pseudobulbs consisting of a single internode. Fls. small, short-pedicelled, in slender racemes, each with a large bract; sepals and petals short, broad; labellum excavated or sac-like; column very short, winged around the top. For cultivation, use strong, light, rich potting material, broken pots, old dry cow manure, plenty of drainage. Do not allow to become very dry. Temperature, 55–65°.

imbricàta, Lindl. Pseudobulbs oblong sulcate: lvs. oblong-lanceolate, plicate, 6–12 in. long: raceme long-peduncled, 3–8 in. long: fls. small, rather crowded on the raceme, white or yellowish, with a shade of violet. Feb.–May. India. B.R. 14:1213; 21:1777. L.B.C. 20:1934.

Chinénsis, Lindl. A small creeping epiphyte. Pseudobulbs cespitose, 1–2-lvd.: lvs. oblong-undulate, acuminate. fls greenish white, in drooping racemes not more than 2–3 in. long; sepals ovate; petals linear; labellum oblong, recurved.—This plant has long been known from Chinese drawings.

WM. MATHEWS and HEINRICH HASSELBRING.

PHORADÉNDRON flavéscens, Nutt., is the Mistletoe of eastern North America. Fig. 1766. It is parasitic on deciduous trees, as far north as New Jersey and southern Indiana and extending southwards to Florida and Texas. F.R. 3:590. It makes dense bunches 1–3 ft. across, with thick oval or obovate yellowish green evergreen lvs. The forking twigs are terete, and break easily at the base. The fls. are diœcious, borne in very short spikes or catkins: berries amber-white, globular, small. The plant is collected for Christmas greens (see *Greens, Christmas*). The Old World Mistletoe is Viscum.

PHÒRMIUM (Greek, *phormos*, basket; referring to one use to which this fiber plant is put). *Liliàceæ*. NEW ZEALAND FLAX. The New Zealand Flax, *Phormium tenax*, is a tender herbaceous plant, 3–6 ft. high, with a tuft of 2-ranked, sword-shaped lvs. and panicles of 6-lobed fls. varying from red to orange. It is a choice plant for conservatory decoration and for subtropical bedding. It is a very formal plant, its lines being strong, stately and rather stiff,—perhaps too much so in immature specimens. The genus is easily distinguished by its fls., which are erect, numerous, panicled, the perianth with a top-shaped tube, and the somewhat incurved segments loosely connivent above. Phormium belongs to the tribe of which the day-lilies (Hemerocallis and Funkia) are representatives in the northern hemisphere and the poker plants (Kniphofia) in the southern, its nearest ally being the Australian Blandfordia with fls. of similar colors but pendulous and with stamens affixed at the middle of the tube instead of at the apex, as in Phormium. Phormiums have a short, thick rhizome and clusters of thickened fibrous roots. There are three species, all from New Zealand. The common species, *P. tenax*, is the tallest plant and generally has redder fls. than *P. Cookianum*. The rarest species, *P. Hookeri* (not in trade), differs in having lvs. which bend back until they reach the ground.

Phormiums are perhaps too slow of propagation to be ranked among the few most popular plants for subtropical bedding, but they are esteemed choice subjects by connoisseurs. They are a prominent feature of many fine establishments in California. When Phormiums are to be prop. by division G. W. Oliver recommends that they be planted outdoors in very sandy soil during May and divided during September.

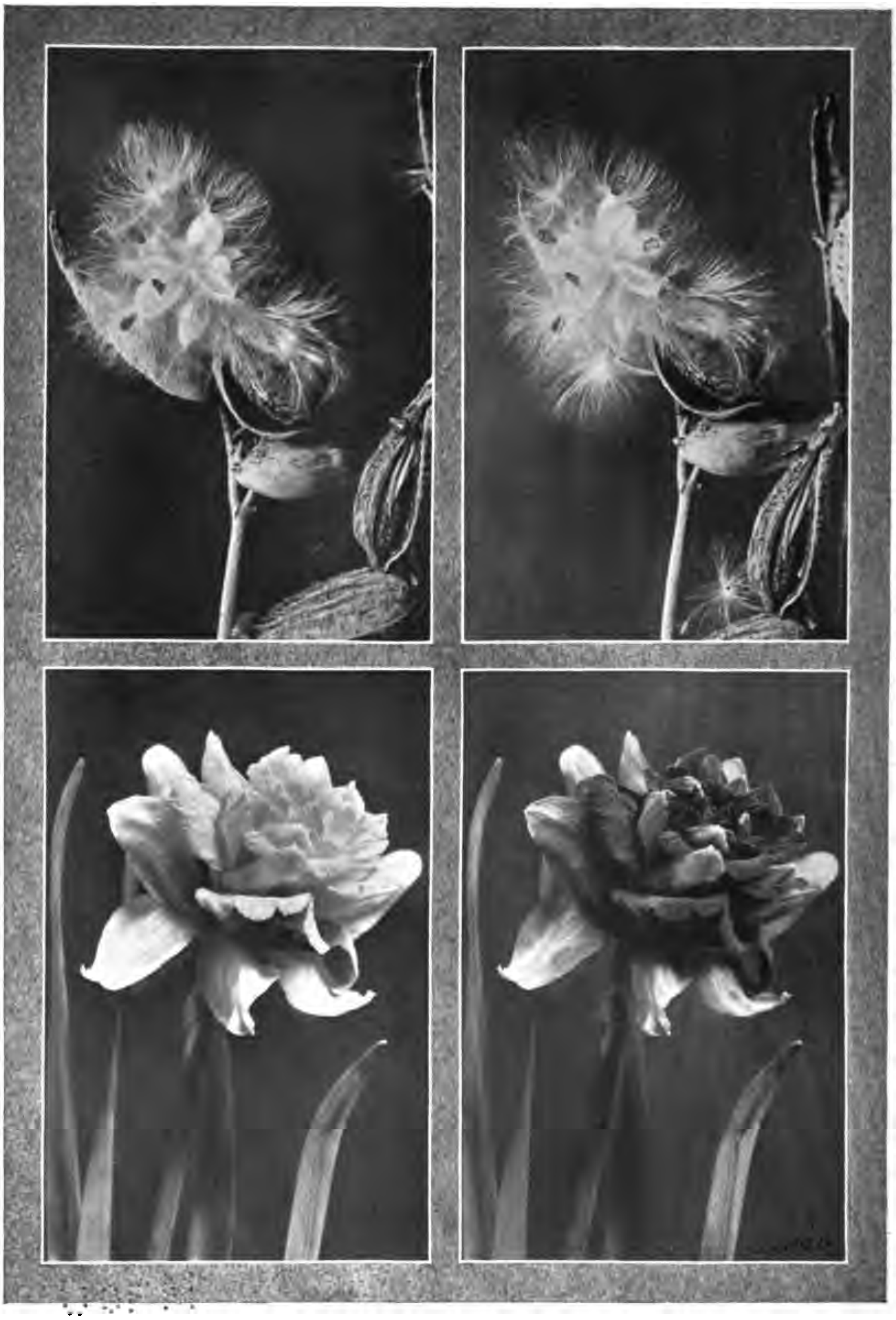
W. M.

For certain combinations and in places where it can have plenty of moisture *Phormium tenax* is a valuable plant, having a very distinct and unusual character all its own. The type is easier of cultivation than the variegated kinds. Much better results can be obtained by raising the typical form from seeds than by division. Seed sown in Feb. and grown on rapidly will make good plants for bedding purposes the spring of the following year. The seedlings may be either planted out or grown in pots; in the latter case give a rich compost and plenty of water after the plants have taken hold. With good treatment one may expect at the end of a year and a half a well-furnished specimen 3–3½ ft. high in a 6-in. pot. If one can afford room in a warm house, so much the better. The variegated forms require partial shade and even moisture; they do not come true from seed.

J. F. COWELL.

A. *Lvs. 2–3 in. wide, split at apex.*

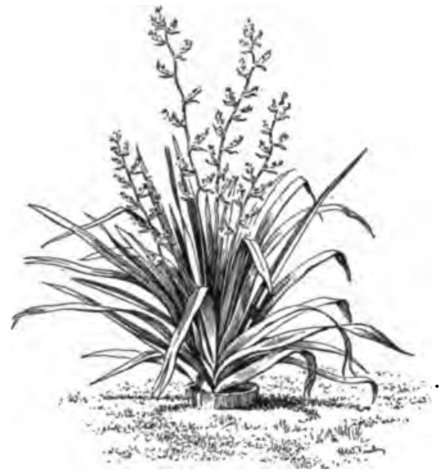
tènax, Linn. NEW ZEALAND FLAX. Fig. 1767. Robust: lvs. attaining 4 ft. or more, 2–3 in. wide, dark green, margin and keel bright red or brownish: scape 5–7 ft. high, much overtopping the lvs.: fls. typically



XXIX. Photography.

The Milkweed pod in upper left corner was photographed upon a "backed" plate to counteract halation; the view to the right shows the same subject photographed without "backing." The yellow Narcissus to the left below was photographed on an isochromatic plate (without color screen); the same flower in the same lighting, made on an ordinary plate, is shown beside it.

scarlet, but in natural forms varying almost to pure yellow; perianth 18–21 lines long. B.M. 3199. Gn. 50, p. 369. A.F. 13:748. R.H. 1848:5. V. 13:340. Gn. 26, p. 397.—Var. **atropurpùreum** has reddish purple foliage. R.H. 1877, p. 389. Var. **atropurpùreum variegàtum** is alleged to be a "veritable fountain of white, purple and rose color." Var. **nigro-pictum** (*N. purpureum nigro-limbatum*, Hort. Saul?). Lvs. deep green, with a narrow margin of blackish purple, which becomes broader and more distinct towards the base, making in mature plants a zigzag line which outlines the 2-ranked habit of the lvs. Var. **variegàtum** has fls. striped creamy yellow and white. R.H. 1878, p. 86. Var. **Veitchiànum** (var. *Vèitchii* and *P. Veitchiànum*, Hort.) has broad creamy white stripes on a light green ground. A.F. 5:39. The type and varieties all have the red margin and the variegated forms are all smaller than the type.



1767. Phormium tenax.

AA. *Lvs. ¾–1½ in. wide, scarcely split at apex.*

Cookiànum, Le Jolis. A smaller plant: lvs. 2–3 ft. long: scape 3–6 ft. high: perianth 12–15 lines long, yellower than the above. Var. **variegàtum** has yellowish white stripes. F.M. 1874:112. W. M.

PHOSPHATE. This word is often used by farmers as synonymous with commercial fertilizers. Consult *Fertility*, *Fertilizers* and *Manures*.

PHOTÍNIA (Greek, *photeinos*, shining; alluding to the shining foliage). Including *Heteromeles* and *Pourthiæa*. *Rosàceæ*, tribe *Pòmeæ*. Ornamental evergreen or deciduous shrubs, with alternate, usually serrate lvs., white fls. in sometimes very large corymbs, and very decorative red or scarlet fr. The evergreen species are tender in N. Eng., and bear only a few degrees of frost; but the deciduous *P. villosa* is hardy as far north as Massachusetts, and is very conspicuous in fall by the scarlet fall coloring of the foliage and afterwards by the numerous scarlet fruits, which retain their bright color until midwinter and are not eaten by birds. Of the evergreen species, *P. arbutifolia*, which is very similar to *P. serrulata* and also to *P. glabra*, is the best known; it is a very striking object in winter, with its large clusters of bright red fr. ripening in December and contrasting well with the glossy dark green foliage. The Photinias are not very particular as to soil, but thrive best in a rather light, sandy loam, and the deciduous ones prefer sunny positions. Prop. by seeds or by cuttings of half-ripened wood under glass and by layers; also by grafting on hawthorn or quince. About 20 species distributed from Japan and China to India and Java, 2 species in Calif. and Mex. Shrubs, rarely small trees with stipulate lvs.: fls. in corymbs or short panicles; petals 5, orbicular; stamens 10–20; styles 2, rarely 3 or 4, connate at the base: fr. a small 1- or 2-seeded pome. Closely allied to the Aria group of Sorbus and only distinguished by the top of the fr. being rounded and hollow.

A. *Lvs. deciduous: fls. in corymbs.*

villòsa, DC. (*P. variábilis*, Hemsl. *Pourthiæa villòsa*, Decne. *Sórbus terminàlis*, Hort.). Upright shrub, to 15 ft., with slender spreading or upright branches: lvs. short-petioled, broadly obovate to oblong, cuneate, acuminate, sharply serrate, dark green and glabrous above, more or less pubescent beneath when young, 1½–3 in. long: fls. white, in 1½–2 in. broad, glabrous or villous corymbs terminal on short lateral branchlets: peduncles warty: fr. about ⅜ in. long, bright scarlet. June. Japan, China. G.F. 1:67.—A very variable species. Var. **lævis,** Rehd. (*P. lævis*, DC. *Pourthiæa argùta*, Hort.), has narrower lvs., only sparingly pubescent when young and soon glabrous, glabrous inflorescences and somewhat larger fr. G.F. 4:377.

AA. *Lvs. evergreen, glabrous: fls. in large panicles*

serrulàta, Lindl. (*P. glàbra*, var. *Chinénsis*, Maxim. *Cratægus glàbra*, Sims, not Thunb.). Shrub, to 20 ft.: lvs. with petioles about 1-in. long, oblong, usually rounded at the base, acuminate, serrulate, dark green and shining above, yellowish green beneath, 5–7 in. long: panicles to 6 in. broad: fls. ¼ in. across; stamens 20: fr. globose, ¼ in. across, red. May–July. China. B.M. 2105. L.B.C. 3:248. Stands fairly well in Washington.

glàbra, Maxim. (*Cratægus glàbra*, Thunb.). Shrub, to 8 ft.: lvs. on about ½-in. long petioles, elliptic or obovate to oblong-obovate, cuneate at the base, acuminate, serrulate, 2–4 in. long: panicles 2–4 in. across: fls. ⅜ in. across; stamens 20: fr. subglobose, red. May–July. China, Japan.

arbutifòlia, Lindl. (*Heteromèles arbutifòlia*, Roem. *Cratægus arbutifòlia*, Ait.). TOYON. TOLLON. Shrub or small tree, to 20 ft.: young branches and inflorescences usually tomentulose; lvs. oblong to oblong-lanceolate, acute at both ends, sharply serrate, shining above, 2–4 in. long: fls. white, in 2–5-in. broad panicles; stamens 10: fr. bright red, ⅜ in. across. June, July. Calif. S.S. 3:193. B.R. 6:491.—Called Christmas Berry in Calif., where the fruits are much used for Christmas decoration.

P. argùta, Wall. (Pourthiæa arguta, Decne.). Closely allied to P. villosa: lvs. longer and narrower, firmer, densely white-tomentose beneath when young: corymbs larger. Himal.—*P. elliptica*, Nichols., is Eriobotrya elliptica, Lindl., a Himalayan species not in cult. in this country.—*P. Japónica*, Nichols.=Eriobotrya Japonica. ALFRED REHDER.

PHOTOGRAPHY, HORTICULTURAL. Plate XXIX. As a means of description and of record, photography is of great importance to horticulture in all its branches. A reference to magazines and to trade catalogues of the day shows a growing use of the "half-tone" engraving process; and these engravings are merely photographs transferred to a copper plate, and by means of minute chemically-etched dots given a printing surface for the typographic press. Many other illustrations — notably many in this Cyclopedia — are adapted from or drawn directly from photographs, being then engraved by another photographic etching process on hard zinc. To a limited extent, photographs are also printed on the prepared surface of boxwood blocks, and used in lieu of a drawing as a sketch for the wood-engraver.

Every experiment station and agricultural college finds in photography an indispensable adjunct both to its records and to its descriptive work. For the botanist, photography provides both an uniquely accurate means of recording plant details, and of portraying the appearance of the growing plant in its habitat. A photographic herbarium represents the living plant more adequately than the usual dried specimens. Some of the larger nursery and seed establishments are also coming to maintain photographic equipments, in order that they may readily preserve views of the varieties which it is desired to advertise. In horticultural journalism photography is of prime importance. In advanced collegiate institutions and at the meetings of various progressive horticultural societies and institutes, the presentation of photographs by means of the stereopticon is found to be of enormous advantage, and the teaching or entertainment is made more efficient through this means. Therefore, all branches of horticultural activity are concerned with photography, and the progressive instructor dealing with horticultural problems in an educational institution, or handling the government's money in the experiment station work, must be able to practice photography with a fair degree of proficiency, if he is to accomplish the best results.

As Horticultural Photography differs essentially from the line of work in which the ordinary portrait photographer is engaged, some special skill and certain items of equipment are desirable for the tradesman, or experimenter, or teacher who wants to make his illustration effective. Those who deal, as does the writer, with many photographs from many "artists," come to know and abhor the thoroughly inadequate work of the ordinary professional, who is fitted both as to equipment and skill only for the picturing of the human face and form. Not once in twenty times does satisfactory and efficient horticultural photographic work come from the professional; and, therefore, the horticultural instructor or tradesman is best served by taking up photography in an independent manner.

Apparatus.—For views outdoors of trees, plants, etc., any view camera of the regulation or of the "folding" type will answer, though, as it is often desirable to obtain relatively large details of fruits or flowers or plants *in situ*, a bellows of more than the usual focal capacity or length is preferred. The modern "long-focus" cameras are suitable, and the size most used by horticulturists is that taking a plate 5 x 7 inches in dimensions. For such size a rectilinear lens with a focal length of seven or eight inches is advisable; and if one of the two lenses forming the combination is available as an objective of about double the focal length of the combination, and the camera is provided with a bellows which draws out several inches beyond the focal length of this single lens, much facility in operation is provided. Any of the modern high-class view lenses are suitable, and those of the anastigmatic type, which are not only rectilinear but also render views in a flat and correct perspective, are preferable. It need not be assumed, however, that the very highest grade lens is essential, for in the hands of a thoughtful and reasonably skilful operator, an ordinary rectilinear lens, costing, for the size mentioned, but $15 or $20, will often do satisfactory work. Whatever lens is used, it should be fitted into a quick-working shutter, as outdoor exposures, with modern rapid plates, must be made in small fractions of a second. The shutter, it may be explained to the unacquainted reader, is merely a convenient device for opening and closing the lens to the light for the interval of time desired by the photographer.

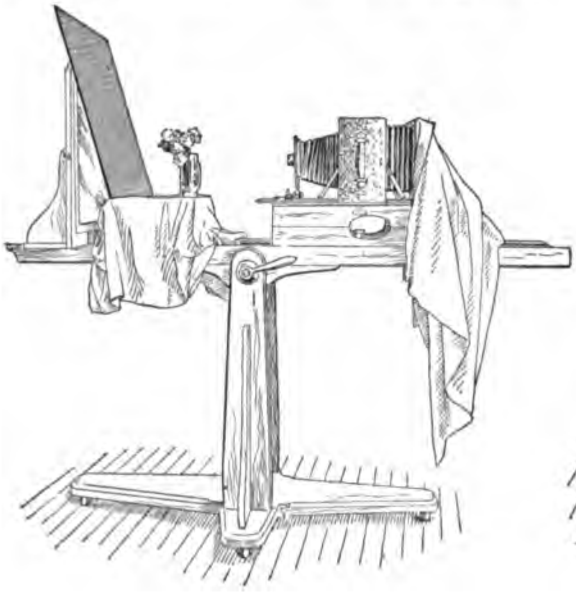
As there is frequent misconception of the work done by a lens, and as even lens-makers sometimes give faulty advice as to the proper objectives for any specified uses, it may not be amiss to suggest to the inquiring horticultural photographer an investigation on his own account. Photo-Miniature No. 1, "Modern Lenses," is a brief, clear and concise statement of the principles, properties and construction of lenses, which may be consulted to advantage. The focal length of any lens, in connection with the size of the plate upon which it is to be used, determines the angle and amount of view included. The human eye is a lens of about 16 inches focal length, and to have a photograph render perspective as seen by the average eye, an objective of the same focal length is required. Thus, on a 5 x 7 plate, a lens of 8 inches focal length will include twice as much in the view, and show it in half the size as seen by the eye. This forced perspective is sometimes desirable and sometimes unpleasant. If the 8-inch lens is composed of two elements on what is known as the symmetrical plan, the rear element may usually be used alone (by screwing out the front lens), and it will have approximately double the focus of the combination. This will give about the perspective seen by the human eye, and will need to be used in connection with a bellows of at least the same length or "draw" as the focal length of the lens. Some of the high-grade lenses are now made on what is termed the "convertible" plan, each of the two elements being of a different focal length. Thus a certain lens which as a whole is of 7⅕ inches focus, includes one element of 12 inches focus and one element of 18 inches focus. Either of these single lenses, or the combination, may be used separately, so that from a given position three views, including proportions differing as 5, 8, and 12, may be made.

To photograph an object in natural size, the double lens is preferable. If the lens be of 8 inches focus, it will give natural size when placed equidistant between the object and the ground-glass focusing-screen of the camera, at double its focal length. Thus the bellows would need to be drawn out so as to have 16 inches between the ground glass and the lens, while the object to be photographed should be maintained in position 16 inches from the lens.

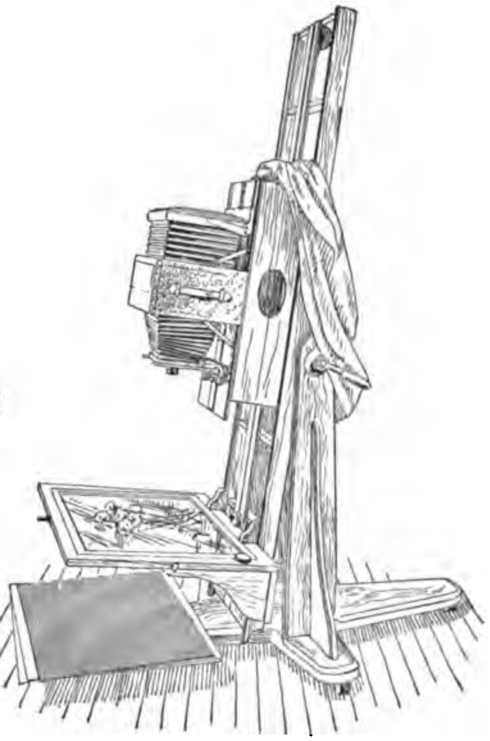
A tripod, capable of adjustment as to height, and of sufficient rigidity to sustain the camera in a moderately high wind, is easily obtained. The cheaper forms are fairly efficient, but the photographer who has much traveling to do finds it preferable to obtain one of the more expensive and carefully fitted types, which fold into a smaller compass.

For indoor work, including the making of photographs of fruits, flowers or plants in large detail, a special form of camera-stand is very desirable. One arranged so that the camera may be maintained in an inclined or nearly vertical plane, while the object to be photographed rests on a plate-glass exposing stand in front of the lens, gives great facility and ease of operation, and does away with many difficulties of illumination. A few experiment stations possess devices of this kind. A form which has been found exceedingly satisfactory in practice is described in No. 13 of the Photo-Miniature, "Photographing Flowers and Trees," and is here reprinted by permission in Figs. 1768 and 1769, showing the camera-stand both as arranged for horizontal and for vertical work. In operation with this device, the flower, fruit or plant to be photographed is laid upon the plate-glass stand, and the camera, fastened by its tripod screw upon a movable bed, is moved backward or forward as a whole, or through its bellows, until the desired size and focus are obtained. The background may be varied to any extent desired by cardboards or cloths placed below or back of the plate-glass stand, out of focus. The camera-stand is mounted on casters, so that it may be readily moved about to secure the most favorable lighting. Objects which can best be handled on a horizontal plane may be disposed somewhat as shown in Fig. 1768. For work of this sort a north side-light is found vastly preferable to the conventional sky-light. A greater mistake in the equipment of a studio for horticultural work could not be made than to provide the sky-light deemed essential by old-fashioned professional photographers, although now happily abandoned by the more progressive workers for a "single-slant" light, which gives far better results. There should be provided in the work-room of the horticultural photographer several good reflecting surfaces, so that the side of the object opposite the main source of light may be properly illuminated.

Plates and color-values.—As practically all Horticultural Photography has to do with the tints of growing things, the well-known color inaccuracy of the ordinary dry-plate is a serious disadvantage. The ordinary plate responds most actively to the rays at the blue end of the spectrum, and is very sluggish in taking an impression from green, yellow and red, the latter color, indeed, being rendered practically the same as black. Yellow, which in actual color value is on a par with light blue, and only a few shades less intense than white, is rendered by the ordinary plate as a dark color, as all operators who have photographed yellow roses, yellow apples, yellow plums, and the like, will have observed. Fortunately, there are available photographic plates, known as isochromatic or orthochromatic plates, which, to a certain extent, correct these difficulties, and the skilful operator may, by the use of the proper plate and in some cases a suitable ray-filter, give approximately correct values to all the colors of the spectrum. For all ordinary horticultural uses, where blue and yellow are not found in the same subject, the isochromatic plate of the most rapid speed is satisfactory. It gives yellow its proper value, at the same time improving the rendering of the green foliage and slightly increasing the truth of representation in pink, lavender, and the lighter red shades. It is very much better, then, for the photographer who has to do with horticultural work to confine himself exclusively to these isochromatic plates for all his work. If he has a subject including blue flowers, the especial activity of the blue rays, which otherwise would render the photographic impression as intense as if the object was white, can be restrained by a suitable ray-filter, which is applied in front of the lens. This ray-filter is either a glass cell filled with a one per cent solution of potassium bichromate, or a piece of plane optical glass covered with a suitably stained collodion film sealed with another optical glass and provided with a convenient mounting for slipping on the lens. With this ray-filter and the isochromatic plate before alluded to, the yellow is slightly over-valued, but the blue is given its proper relation. The beauty of outdoor photographs is vastly increased by the use of the plate and ray-filter mentioned, because a proper color value is given to the sky, and the cloud forms are preserved in all their attractiveness. If the subject be a heavily loaded peach tree, for instance, the accentuation of the yellow, brought about by the use of the ray-filter, will give a needed slight exaggeration of color value to the fruit, which, under treatment by an ordinary plate, will be almost indistinguishable from the mass of foliage. With the ray-filter the exposure required is practically trebled. In this Cyclopedia, advantage has been taken of isochromatic plates in photographing some of the subjects. The carnations, Plate IV, Vol. I, show a variety of shades properly rendered by the means indicated. The dahlia, Plate IX, shows the rendering of dark red shades in connection with green foliage by the isochromatic plate. The persimmon plate (XXVIII) in this volume also shows orange, yellow and red fruits as properly rendered under this isochromatic handling, and the oranges (Plate XXIII), including fruits from the light lemon-yellow Pomelo to the deep orange-red Tangierine, prove also the usefulness of the plate suggested.



1768. Adjustable camera-stand, horizontal position.



1769. Adjustable camera-stand, vertical position.

A difficulty known in photographic practice as *halation* must also be counteracted if the fine detail of subjects involving much light is to be preserved. Plate XXIX shows a milkweed pod, first as photographed with a plain isochromatic plate and second as photographed with the same plate, treated so as to eliminate halation. (The two lower figures on the same plate show the value of the isochromatic plate as compared with the ordinary plate in photographing yellow tulips.) Halation is caused by the reflection of brilliantly lighted objects from the *back* of the glass plate carrying the sensitive emulsion. Light possesses enormous velocity, and there is a constant and almost inconceivably rapid play back and forth between the two surfaces of the glass plate, which is covered only on its face by the sensitive photographic emulsion. This results in a thickening of all the finer lines which should be rendered in the positive as white. It is best counteracted by "backing" the plate with a composition which will absorb all the rays of light that pass through the emulsion on the face. Any dark substance which can be brought into absolute optical contact with the posterior surface of the glass plate will answer, but the most efficient backing is provided by an alcoholic solution of soap, to which has been added a mixture of erythrosin and aurin, two red aniline pigments having high absorptive powers. This coating is easily applied, and easily removed before development; and the writer in his practice of Horticultural Photography uses isochromatic plates backed with this dyed soap-solution for all important work.

Even with the aid of the isochromatic plate and the ray-filter the photography of shades of red is difficult, because of the lack of actinic or chemical quality in the red rays of the spectrum. In practice it is found necessary to give a very much prolonged exposure to objects containing red, and then to restrain the overexposure upon development by means of a suitably compounded developing solution. Details regarding this are out of place here, but may be obtained from the works cited at the end of this sketch.

Lantern-slides.—A few words may be added concerning the production of lantern-slides, now of the greatest importance in illustrative work. A lantern-slide is a positive on glass, and therefore is made from a negative. It is made preferably on a special plate, much slower than the regular photographic dry-plate, because coated with a silver chloride rather than a silver bromide emulsion. The slide is usually faced with a paper mask, so as to include only the desired portions of the picture, and protected by a cover glass. Negatives of any size may be used if a suitable arrangement is provided for reduction. This can readily be arranged by an adaptation of the camera-stand illustrated in Fig. 1768. A pair of light bars are added, running from the top of the plate-glass frame to a support at the other end of the stand, and a piece of heavy muslin or light canvas thrown over this serves to exclude the excess of light. A ground-glass frame is added back of the plate-glass, which latter is removed to give place to a turn-table arrangement, made to take and hold negatives of various sizes. In practice, the ground glass end is turned toward the strong light, the negative to be used is adjusted in the turn-table, and the image focused in the camera as usual. The 5 x 7 size largely used by horticulturists is in just the right proportion for the ordinary lantern plate of American practice, which is 3¼ x 4 inches. Slides may also be made by contact, if the negative to be used is of suitable size. The familiar 4 x 5, 3½ x 3½ and 3¼ x 4¼ hand-camera films are often so used, being placed in contact with a lantern plate in an ordinary printing frame, and given a short exposure to an artificial light. Such slides are seldom of good quality. If it is required to make lantern-slides from diagrams, engravings or any positive material, a negative must be first prepared, for making which the vertical position of the camera stand (Fig. 1769) is very convenient.

In making lantern-slides, it is important to learn the proper exposure, for errors in exposure cannot be corrected in development to any great extent. The careful worker will expose several plates upon the same subject, give all the same development, and act upon the experience thus gained.

The only work treating specifically of the photography of flowers and trees is a previously mentioned monograph in The Photo-Miniature, No. 13, published by Tennant & Ward, New York. In the same series of monographs is an excellent treatise on the production of lantern-slides (No. 9), and another on modern lenses (No. 1), previously cited. J. Horace McFarland.

PHOTOSYNTHESIS. The term Photosynthesis is derived from Greek words signifying "light" and "putting together." It is applied to that process by means of which, under ordinary circumstances, green plants build up organic or carbon-containing compounds. Carbon is the element which as a rule denotes organic substance. It is an essential constituent of the cell wall, or fiber, and of the protoplasm; likewise of starch and of sugar. Green plants manufacture practically all of the organic matter which may eventually furnish food for plants and animals, so that all life is ultimately dependent upon them.

Ordinary air contains only about .04 per cent of carbon dioxid; yet the green plant as a rule obtains all of its carbon from the air. Chlorophyll and light are absolutely essential in order that organic substance may be manufactured. Chlorophyll, the substance which gives the green color to leaf and branch, usually occurs in definite plasmic bodies, which are commonly oval in form. These chlorophyll bodies absorb radiant light and thus obtain energy or power to work. This energy cannot be obtained by the common plant in any other way, as by the absorption of radiant heat from a stove. The cell sap absorbs the carbon dioxid which has diffused into the leaf (see *Physiology of Plants*), and the energy obtained from light works upon the molecules of carbon dioxid (CO_2) and water (H_2O) of the cell sap in such a way that these molecules are rearranged and united. A molecule of some simple carbohydrate, perhaps formaldehyde (CH_2O), is formed; and some of these molecules are perhaps immediately condensed to sugar ($C_6H_{12}O_6$). In this process more oxygen is supplied by the water and carbon dioxid than can enter into the organic product, and this surplus oxygen is thrown off. This whole process is called photosynthesis.

An accumulation of sugar in the leaf would hinder the further manufacture of this product and much of the sugar formed is, indeed, immediately diffused to other cells. The leaf assimilates very rapidly in sunlight, and the surplus sugar formed is changed to starch, an insoluble product. This starch is usually removed from the leaf at night. In some way potassium salts seem to be necessary in the first manufacture of sugar, perhaps aiding in the condensation changes.

It is probable that no plant containing chlorophyll in genetic connection with its protoplast remains long entirely inactive in assimilation, when illuminated. The red end of the spectrum embraces the colors which are principally concerned in the activity of the chlorophyll function. Photosynthesis is most rapid under those conditions of temperature and food supply which best stimulate growth. The process is more rapid, however, when the amount of carbon dioxid in the air is slightly increased. The presence of other coloring matters, such as brown and red, in the assimilating organs does not mean that chlorophyll is absent, and that other substances may replace it. Chlorophyll may be present but veiled by a more prominent color. It is improbable that any other coloring matter besides chlorophyll and a related substance, etiolin, is effective in carbon dioxid assimilation.

Photosynthesis may be inhibited by too intense light, by extremes of temperature, and by deleterious chemical agents. It ceases immediately in darkness, and is very feeble in weak light.

The results of photosynthetic activity may be noted in this way: An active branch of elodea or other pond weed may be kept in a vessel of water in the dark until it shows no starch with the iodine test. The branch is then placed in spring water, which contains considerable air. On placing the experiment in sunlight, bubbles of oxygen will immediately be given off. This indicates that photosynthesis is active; and after a time starch may be found in the leaves. B. M. Duggar.

PHRAGMÌTES (Greek, *growing in hedges*, which, however, does not apply to this grass). *Gramineæ.* Species 3, one in tropical Asia, one in South America, and one, our species, cosmopolitan. Tall and stout perennial reed grasses with long running rootstocks and terminal panicles with aspect of Arundo. Spikelets 3–7-fld. Differs from Arundo chiefly in having the lowest fls. staminate, the flowering glume sharp-pointed but not bifid, and the hairs of the spikelet confined to the rachilla.

commùnis, Trin. Common Reed. Culm usually 8–12 ft. high: lvs. 2 in. wide. Marshes and along edges of ponds. The ornamental feathery drooping panicles appear in late summer or autumn. Gn. 31, p. 33.

A. S. Hitchcock.

PHRỲMA (one of the many names which Linnæus never explained). *Verbenàceæ.* A genus of one species, a hardy, perennial herb of little horticultural value. It has slender branches, coarsely toothed ovate lvs. and small purplish or rose-colored opposite fls. borne in long, slender terminal spikes. It seems to have been rarely cult. in Europe and is offered by one American dealer in native plants.

Phryma is an outlying member of the Verbena family, and is by some authors made the sole example of a family of its own. This is because its ovary is 1-celled, while the rest of the Verbenaceæ, as a rule, have a 2- or 4-celled ovary. There is some evidence for regarding it as a 2-celled verbenaceous plant in which only half of the ovary develops. This plant has the inflorescence of the Verbena tribe and the habit of Priva. Generic characters are: ovule solitary, erect, orthotropous, laterally affixed at the base: seed without albumen; cotyledons convolute; radicle superior.

Leptostàchya, Linn. Lopseed. Height 2–3 ft.: lvs. 3–5 in. long, thin, the lower long-stalked: fls. at first erect, soon spreading and the calyx in fruit closed and abruptly reflexed against the axis of the spike, the teeth long, slender and hooked at the tip. June–Aug. Common in moist and open woods, Canada to Minn., South to Fla. and Kans. B.B. 3:205.

PHRỲNIUM (from Greek word for toad, because the plant inhabits marshes). *Scitaminàceæ.* About 20 herbs of the Old World tropics with creeping rootstocks and large oblong showy radical leaves. The genus is closely allied to Calathea and Maranta and is often confused with them. The Marantas are New World plants with 1 seed-bearing locule in the fruit, whereas Calathea and Phrynium usually have 3 seed-bearing locules. In Calathea, the flower-cluster is terminal on a leafy stem or rarely on a leafless scape arising directly from the rhizome; in Phrynium, the cluster is lateral from the sheathing petiole. In Calathea the corolla-tube is usually slender; in Phrynium it is usually short. Phryniums are grown the same as Calatheas and Marantas (which see). It is probable that there are no true Phryniums in the Amer. trade. **P. variegàtum,** N. E. Brown, is *Maranta arundinacea*, var. *variegata*. It is a stove plant of dwarf habit with ovate-lanceolate acuminate green leaf-blades which are marked with cream-white or white stripes and bands. I.H. 33:606. F.R. 3:469. Gt. 46, p. 581. J.H. III. 28:27. It is a worthy plant, now coming to be popular. For *Phrynium eximium*, see *Calathea eximea*. L. H. B.

PHYGÈLIUS (*flight* and *sun*, because it was said to love the shade). *Scrophulariàceæ*. Two species of south African shrubs, one of which is in the trade. The flowers are long and tubular, not unlike those of a Pentstemon in looks, scarlet, with exserted stamens in 2 pairs, and a long, filiform declined style: fr. a many-seeded capsule. The lvs. are opposite and petiolate, crenate-dentate.

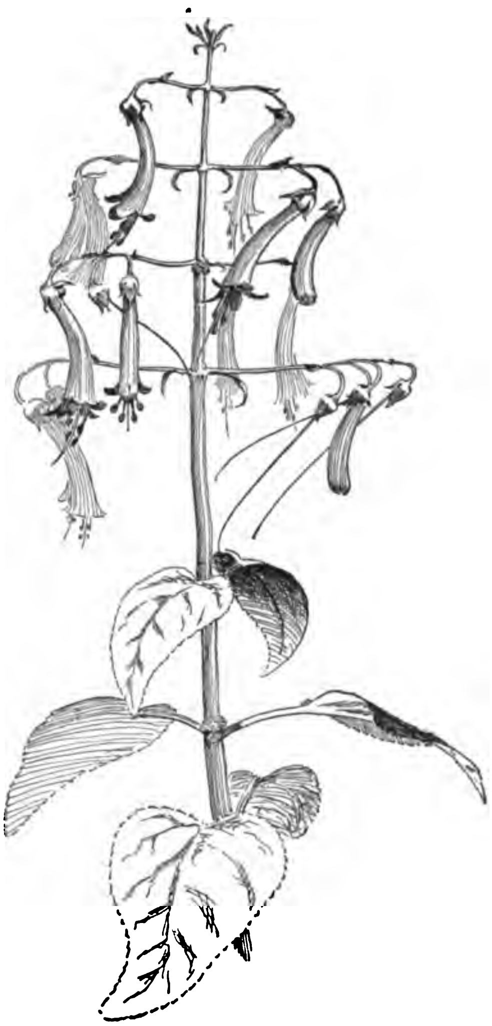
Capénsis, Meyer. CAPE FUCHSIA. Fig. 1770. Erect, becoming woody at the base, glabrous, the stem with 4 angles or narrow wings: lvs. ovate, rounded at the base, firm and veiny, bluntly small-toothed: fls. slender, 2 in. long, somewhat curved, 2-lipped, purple-scarlet, 1–4 together on the ends of straight-spreading peduncles, drooping. Cape of Good Hope. R.H. 1857, p. 599; 1886, p. 473. B.M. 4881. F.S. 11:1111.—A fine subshrub blooming in summer and hardy in protected places as far north as Philadelphia. In the North it is lately becoming known as a greenhouse plant. It is excellent for planting out, enduring heat and dry weather as well as geraniums, or even better. It is propagated by seeds and also by cuttings. The cuttings may be taken from the late fall shoots of outdoor plants. Phygelius is a showy plant, deserving to be better known. L. H. B.

PHYLLÁGATHIS (Greek, *divine leaf*). *Melastomàceæ*. Four species of herbs from the Malay Archipelago belonging to a family noted for its numerous stove foliage plants. The lvs. of *P. rotundifolia* are praised for their colors, both above and below, their venation, their plaited character, and their strong shadows and reflected lights. The lvs. are glossy green above, tinted along the nerves with metallic blue and purple; beneath they are a rich coppery red, with the prominent nerves of a brighter color. About 10 strong nerves sweep with graceful curves from base to apex.

These plants have short, thick stems: lvs. opposite or the terminal solitary, large-petioled, roundish, cordate at the base, entire or denticulate: fls. crowded into a short-peduncled head, rosy, about ½ in. across; petals 6, rarely 3; stamens 8, rarely 6: ovary 4-celled, rarely 3-celled; capsule top-shaped, 4-valved. The nearest ally in cult. is Sonerila, which ordinarily has 3 stamens, rarely 6.

"*Phyllagathis rotundifolia* belongs to the same family as the better known *Sphærogyne latifolia* and *Cyanophyllum spectabile*. It somewhat resembles the former in general appearance. A few plants of it were given a test outside during the summer at Washington, D. C., in 1899, in a position partly shaded from the sun. They behaved well, and in such a situation, where the surface of the soil is covered with some low-growing plant, as Hydrocotyle or Lysimachia, to keep the sun from the roots, it may become a valuable feature for outdoor decoration. But for indoors, it may be used as a substitute for the more gaudy-leaved Sphærogyne, as it succeeds in an atmosphere in which the majority of greenhouse plants can be grown. Propagation for small plants is by the leaf, the petiole of which is inserted in sand, the blade lying flat on the surface, and the ribs severed in several places. From the cut parts nearest the petiole, numerous small growths are made; these may be potted when an inch or so high. For making specimen plants quickly, old subjects which have been encouraged to branch may be cut up, and the pieces inserted in pots in bottom heat. They send out roots very quickly."—Oliver's "Plant Culture."

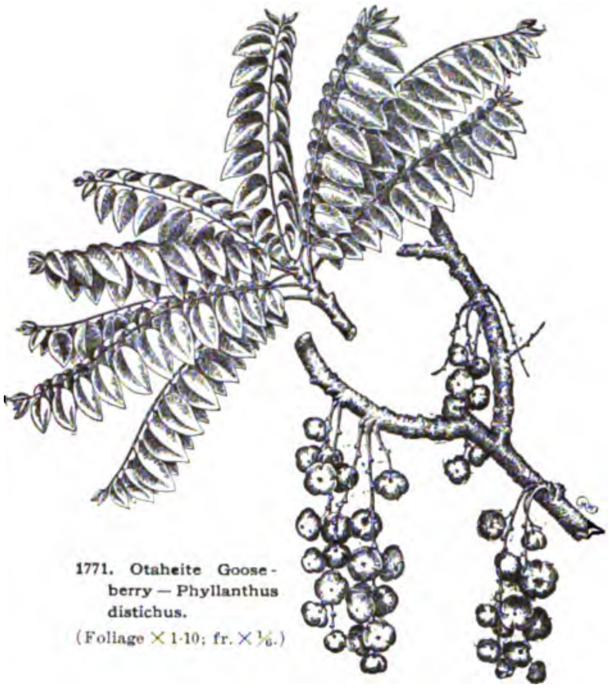
rotúndifolia, Blume. Stem rooting at intervals, 4-sided, dark purple: lvs. 6 in. or more by 4½ in., roundish ovate, abruptly acuminate, denticulate: floral parts in 3's or 4's. Sumatra. B.M. 5282. W. M.



1770. Phygelius Capensis (× ½).

PHYLLÁNTHUS (Greek, *phyllon*, leaf, *anthos*, flower; because the flowers are apparently borne on leaves). *Euphorbiàceæ*. Herbs or shrubs, without milky juice: lvs. small, alternate, entire, usually in 2 lateral rows on the small branchlets which then appear like pinnate lvs.: fls. axillary, apetalous, monœcious or diœcious, the staminate in small clusters without a rudimentary pistil, pistillate solitary; sepals 4–6, separate from the disk, imbricated; stamens 2–6 or more, usually 3: capsule with 3 to many 2-seeded cells, often fleshy; embryo large: cotyledons broad.

More than 400 species, mostly in tropical regions. A few only are cult., mostly for their graceful foliage. Monographed by Mueller in DC. Prod. 15, II:274, where he divided the genus into 44 sections, some of which, as Emblica, Cicca and Xylophylla, have been considered by others as separate genera.



1771. Otaheite Gooseberry — Phyllanthus distichus.
(Foliage × 1-10; fr. × ⅙.)

A. *Foliage of large, broadly ovate-elliptical variegated lvs., not pronouncedly distichous.*

nivòsus, Smith. Snow-bush. Shrub of loose habit, with dark wiry somewhat zigzag branches: lvs. 1–2 in. long, obtuse, white and green mottled: fl. small, greenish, discoid, hanging by long pedicels from the leaf axils. S. Sea Islands. F.M. 1874:120. I.H. 25:332.—Var. **ròseo-píctus,** Hort. Lvs. mottled with pink and red as well as white and green. Gn. 10, p. 261. F. 1878, p. 13. —Used in the house and for bedding out in summer.

AA. *Foliage of narrowly elliptical or ovate, distinctly distichous green lvs.*

Émblica, Linn. Emblic Myrobolan. A much-branched shrub or small tree: foliage branches with many linear-elliptical, obtuse lvs., which are close together and ½–¾ in. long: fls. small, short-pedicelled in the axils of the lower lvs.: capsule baccate, ¾–1 in. in diam. E. Indian region. L.B.C. 6:548.—Fruit used raw or preserved: foliage handsome.

dístichus, Muell. (*Cicca disticha*, Linn.). Otaheite Gooseberry. Fig. 1771. Shrub, with ovate acute lfts. 1–2 in. long: fls. on separate branches below the foliage: fr. fleshy, edible. India and Madagascar.—W. Harris, of Hope Gardens, Jamaica, W. I., writes that the Otaheite gooseberry is an elegant shrub or small tree often cultivated in gardens in the lowlands of Jamaica and the West Indies. The fruit is very acid and astringent; the root is an active purgative, and the seed is also cathartic. The fruit is occasionally pickled, or made into preserves. Plants are raised from seeds.

púlcher, Wall. (*P. pallidifòlius*, Müll. *P. glaucéscens*, Hort. ? *Rèidia glaucéscens*, Miq.). A small shrub: lvs. much like the last, but ovate-elliptical, ½–1½ in. long, glaucous below: fl. small, red and yellow, the pistillate near the end of the foliage branches, on long pedicels, the staminate below; sepals laciniate: capsule small, globose, puberulent. Java. B.M. 5437. G.F. 4:161.

AAA. *Foliage of flattened stems bearing scale-like lvs. and fls. on the margin.*

speciòsus, Jacq. (*P. arbúscula*, Gmel.). A small shrub: floriferous branches, lanceolate, striate, crenate, 2–3 in. long. Jamaica. B.M. 1021 (as *Xylophylla latifolia*).

P. angustifòlius, Sw. B.M. 2652. Near speciosus. Fls. small and yellowish on the margins of the branches. Known as Xylophylla montana. Native to Jamaica.—*P. atropurpùreus*, Hort.—var. of P. nivosus, with dark purple lvs.—*P. Chantrièri*, André. R.H. 1883, p. 537. Sepals fringed. Cochin China.—*P. salviæfòlius*, HBK. R.H. 1883, p. 176. Leaflets truncate. Fls. small, somewhat globular. S. Amer.

J. B. S. Norton.

PHYLLIRÈA. See *Phillyrea*.

PHÝLLITIS (Greek, *a leaf;* from the simple foliage). *Polypodiàceæ.* A genus of ferns popularly known as the Hart's-tongue fern, with simple lvs. and elongated sori at right angles to the midrib; indusium appearing double from the coalescence of two sori, one produced on the upper side of a veinlet and the other on the lower side of the veinlet next above.

Scolopéndrium, Newman (*Scolopéndrium vulgàre*, Sm.). Hart's-tongue. Lvs. 10–15 in. long, heart-shaped at base, 1–2 in. wide, growing in tufted clusters. Widely distributed in Europe, where there are many curious varieties in cultivation; and local on corniferous limestone in central New York; also in Canada and Tennessee.

L. M. Underwood.

PHYLLOCÁCTUS (Latin, *phyllum*, a leaf; from the flattened leaf-like stem). *Cactàceæ.* Branches flat, two-edged, crenate on the margins, the crenatures bearing the flowers, and bristles rather than spines. The fruit is often angled, usually scaly, but without spines or wool. About a dozen species are recognized by botanists, but few are known in the wild state, and most of them have so profusely hybridized with each other and with species of Cereus, especially *C. speciosus*, and even with Echinopsis, that many of the forms in cultivation are wholly doubtful. In strict priority the genus should be called by the older name Epiphyllum, under which nearly all the species have received names.

In their native haunts Phyllocacti are often epiphytic; consequently in cultivation they do not require as much sunlight as most other genera of Cactaceæ, and water can be more freely supplied to them. See also *Cacti*.

There are hundreds of Latin names in the catalogues which seem to represent species, but they are horticultural varieties or hybrids. One of the hybrid forms is shown in Fig. 1772.

1772. One of the many hybrid Phyllocacti (× ¼).

A. *Tube of fl. 4–8 in. long: flowers white or yellowish white within, often rosy on the tube and outer sepals, 4–10 in. in expansion.*

B. *Style white.*

grándis, Lem. Very large, sometimes 20 ft. long: stems slender, round or 2-edged, with flat, leaf-like, lanceolate, often very long and large, undulate branches: fls., including the tube, nearly 1 ft. long, 5–6 in. in expansion, opening, according to Schumann, in the daytime. Honduras; also said to be found in Cuba.

crenàtus, Lem. In cult. commonly not much more than 3 ft. high, freely branching from the lower part of the stem: branches thick, with a strong midrib, but thinning to the edges, which are rather deeply crenate: fls. greenish yellow outside, 6–10 in. long, and about as much in expansion, day-blooming. Honduras.

angùliger, Lem. About 3 ft. high, many-stemmed: basal stems cylindrical, hard and woody, the large leafy branches deeply cut in the margins, like the teeth of a very coarse saw: fls. 5–8 in. long, the tube very slender. South Mexico. B.M. 5100.

BB. *Style red.*

stenopétalus, Salm-Dyck. (*P. lâtifrons,* Zucc.?). Branches very long and large, crenate or somewhat serrate, acute or acuminate: midrib and usually side ribs evident; areolæ with rather large scales and dark bristles: fl. 8–10 in. long, spreading and in full bloom bent backwards; petals narrow. Perhaps from Mexico.—Much advertised as the Queen Cactus.

Hoòkeri, Salm-Dyck. Branches long but narrow, crenate-serrate, in age dark or bluish green, often reddish on the margins; midrib strong and side ribs evident: fls. 6–8 in. long, yellowish white within, reflexed in full bloom. Brazil and Guiana.

stríctus, Lem. Erect, branching, reaching a height of 10 ft., with long cylindrical branches and shorter, leaf-like secondary branches: crenatures or teeth rather deep, unequal on the opposite sides; bristles wanting: tube of the fl. very long and slender, outer sepals brownish, inner pure white; the flower opens late in the evening and closes before dawn; in full bloom the sepals are very strongly recurved. Said to come from the island of Cuba.—Often found in collections under the name of *P. latifrons*.

AA. *Tube of fl. very short: fls. red. Day bloomers.*

Áckermanni, Salm-Dyck. Fig. 1773. Stems numerous, sometimes reaching 3 ft., somewhat recurved: branches usually less than a foot long, with evident middle and side ribs; areolæ on the lower and younger shoots bearing short bristles: fls. scarlet-red outside, carmine-red within, the throat greenish yellow, tube very short, the limb wide-spreading, 4–6 in. in diam. B.R. 16:1331.—Not known in the wild state.

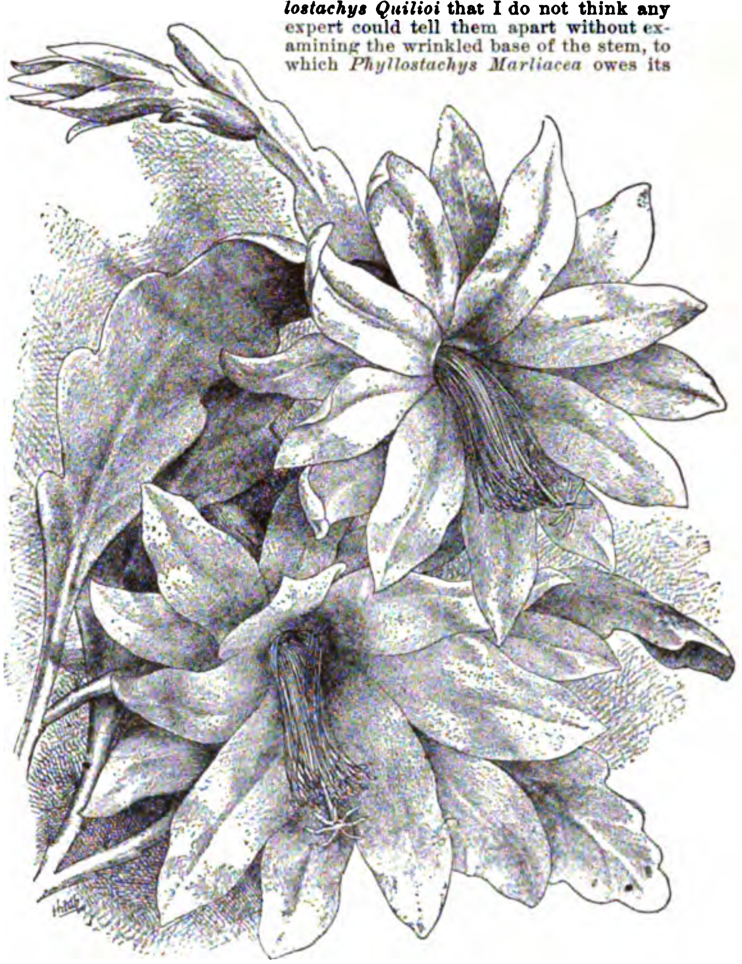
phyllanthoìdes, Link. Branches at length hanging, cylindrical at base, lanceolate above: serratures obtuse; middle and side ribs evident; bristles few: fl.-tube 2 in. long or less, with spreading scales, the limb somewhat longer, often striate. South Mexico.

bifórmis, Lab. Soon pendulous, the branches cylindrical: short branches leaf-like, the lower egg-shaped, the upper more lengthened: fls. small, purple-red, less than 2 in. in expansion: ovary without scales or angles. Honduras. B.M. 6156. V. 2:159.

In addition to the species described above, the following are recognized by Schumann: *P. acuminatus, caulorrhizus, Gærtneri, phyllanthus, Russelianus* and *Thomasianus*. Of these, *P. Gærtneri* and *Russelianus* are usually included in Epiphyllum; *P. caulorrhizus* is perhaps an unusual state of some other species; *P. Thomasianus* described from a garden plant is almost certainly a hybrid. *Epiphyllum Guedneyri* is by some referred to Phyllocactus.

KATHARINE BRANDEGEE.

PHYLLÓSTACHYS is treated under Bamboo. *P. heterocycla*, now in the trade, is in the supplementary list on page 130. Since the Bamboo article was printed, *P. Marliacea* has been introd. to American trade. It is a rare bamboo, hardy in England, of which Mitford says: "It presents such a marked resemblance to *Phyllostachys Quilioi* that I do not think any expert could tell them apart without examining the wrinkled base of the stem, to which *Phyllostachys Marliacea* owes its Japanese name, Shibo-chikee, 'the wrinkled bamboo,' and which makes it so useful for canes and umbrella sticks."



1773. Phyllocactus Ackermanni (× ⅓).

PHYLLOTÆNIUM. See *Xanthosoma*.

PHYMATÒDES (Greek, *a close network*). *Polypodiàceæ*. A genus of ferns allied to Polypodium and sometimes united with that genus, but differing in the fine copious irregular areolæ formed by the anastomosing veinlets and the free included veinlets spreading in every direction. For culture, see *Fern*.

A. *Lvs. simple.*

Swártzii, Underw. (*Polypòdium Swártzii,* Baker). Lvs. 2–4 in. long, ¼–1 in. wide, narrowed gradually toward both ends: sori in a single row each side of the midrib. Florida Keys and tropical America.

musæfòlium, Blume. Lvs. 1–3 ft. long, 3–4 in. wide, with an acute point, the lower part winged to the base; main veins very distinct, with numerous small sori almost covering the whole surface. East Indies.—Known also as *Drynaria* and *Polypodium musæfolium*.

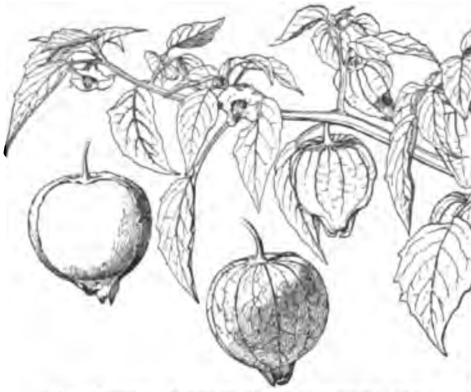
AA. *Lvs. deeply pinnatifid.*

nigréscens, Blume (*Polypòdium nigréscens*, Blume). Lvs. 2–3 ft. long, 1 ft. or more broad, cut nearly to the rachis into numerous entire lobes 1–2 in. wide; surfaces naked, dark green; sori in a single row nearer the midrib than the edge, sunk in deep cavities which are prominent on the upper side. India to Polynesia.

glaùcum, Kunze (*Polypòdium glaùcum*, Kunze). Lvs. 12–18 in. long, 6–8 in. broad, cut down to a winged rachis into entire lobes ⅜ in. or more wide, both sides naked, glaucous; veinlets indistinct: sori forming a single row close to the midrib. Philippine Islands.—*Phlebòdium Màyii*, Hort., A.G. 19:455. F.E. 10:600, is a horticultural form. G.C. III. 23:328, fig. 21.

L. M. UNDERWOOD.

PHÝSALIS (Greek for *bladder*, because the thin calyx enlarges and incloses the fr.). *Solanàceæ*. HUSK TOMATO. GROUND CHERRY. Herbs of warm or temperate countries, the larger number American. They are variable and therefore confusing to the systematist.



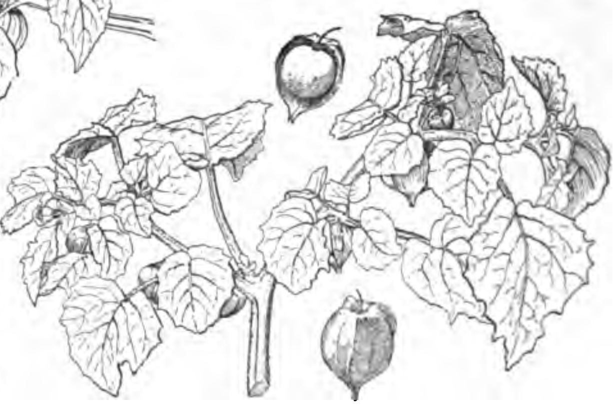
1774. Physalis ixocarpa in its cultivated form (fruits × ⅓).

The species number anywhere from 30 to 100 or more, depending on the author. The genus is allied to Nicandra, and more remotely to Capsicum, Lycopersicum and others. The flowers are usually not showy, and are much like those of Solanum in structure: corolla rotate or short bell-shaped, plicate in the bud, 5-lobed or 5-angled, usually blue or yellowish, borne solitary in the leaf axils; stamens not united or connivent. The calyx greatly enlarges in fruit, becoming a bladder inclosing the 2-loculed mostly yellow or greenish berry. Lvs. alternate, mostly angled and usually distinctly stalked. Most of the species are of little consequence horticulturally, although *P. Alkekengi* and *P. Francheti* are much prized for the glowing red very large calyxes, and *P. pubescens* and *P. Peruviana* are grown for their edible fruits. Several of the species are known for their fruits where they grow in a wild state. In most parts of the U. S. and Canada one or more species grow about gardens, in fields, and in waste places. These species are popularly known as Ground Cherry. The fruits are usually made into preserves, although they are sometimes eaten raw. The common cultivated species are annuals, or are usually treated as such in this country. They require no extra care. Usually the seeds are sown indoors in the North, in order to secure as much of the crop as possible before frost. Most of the cult. species are long-season plants, and therefore need to be forwarded in the spring. The high colors of *P. Alkekengi* and *P. Francheti* do not develop until the fruit is ripe. Give a warm, sunny exposure. The plants do not withstand frost. Let the plants stand 1–2 ft. apart in the row.

A. *Plants with large red calyxes in fruit.*

Alkekéngi, Linn. ALKEKENGI. STRAWBERRY TOMATO. WINTER CHERRY. BLADDER CHERRY. Diffuse grower, usually with zigzag mostly simple angled pubescent stems: lvs. ovate, with broad base, angular, the petiole widening at the top: fls. whitish, the anthers yellow: fr. red (sometimes eaten), the ripe large calyx blood-red and very showy. Seems to be native from southeastern Europe to Japan, but now adventive or naturalized in many parts of the world. Gn. 41, p. 577; 49, p. 233; 57, pp. 28, 432.—The Strawberry Tomato is an old garden plant, grown for its highly colored bladders. The plant grows 12–18 in. tall. Of easiest culture. In the North, plants are usually started indoors. It is a perennial, the roots withstanding much frost if protected, but it is usually grown as an annual. Not hardy in the northern states.

Franchéti, Mast. (*P. Alkekéngi*, var. *Franchéti*, Hort.). CHINESE LANTERN PLANT. Differs from *P. Alkekengi* chiefly in its greater size, making a plant 2 ft. tall and bearing calyxes 2 in. in diam. In his original description of the species, Masters (G.C. III. 16, p. 434) makes the following characters: "It differs from *P. Alkekengi* in being an unbranched annual, not a perennial, with a fibrous root, with erect branches, not creeping at the base, glabrous instead of setose, in its much larger size, in the leaf-stalks being considerably shorter in proportion to the blade." Japan. G.C. III. 16:441. Gn. 48, p. 435; 49:1059; 57, p. 28; 58, p. 196. G.M. 37:626. J.H. III. 29:343. R.H. 1897:376 and p. 35. R.B. 22:61; 23, p. 91. Gt. 45, p. 636; 46, p. 193. A G. 18:81. F.R. 1:426.—One of the most profusely advertised novelties of recent years. It is a most striking and showy plant. It was brought to England from Japan by James H. Veitch, and first described with a name by Masters in 1894. In 1879, however, it had been described by Franchet, of the Jardin des Plantes, Paris, as a form of *P. Alkekengi*, but without name. The fruits are very brilliant orange-red in the fall. The berry is said to be edible. Some writers describe the plant as perennial.



1775. Physalis pubescens (fruits × ⅓).

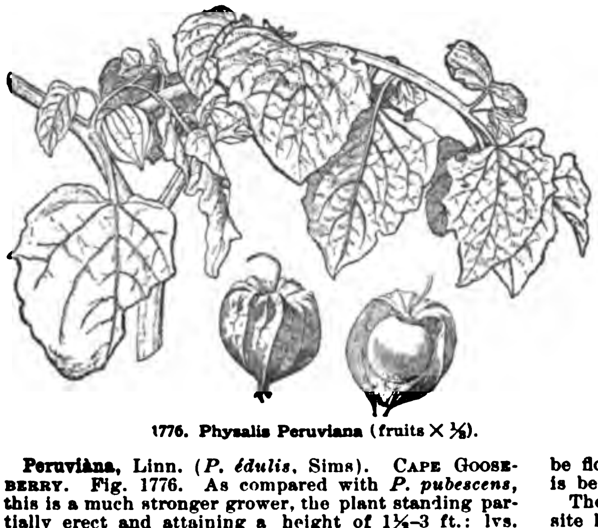
AA. *Plant with green or yellow or at most only red-veined calyxes. Mostly grown for the edible berry.*

B. *Stems glabrous or very nearly so.*

ixocárpa, Brot. Fig. 1774. Erect, 3 or 4 ft. tall, bearing smooth branches and lvs., the latter thin, ovate or lance-ovate and variously toothed or notched: fls. large and open (¾ in. or more across), the border bright yellow and the throat bearing 5 black-brown spots; anthers purplish: husk purple-veined and entirely filled by the large round, purplish sticky berry, and is sometimes torn open by it. Mexico, and introduced northwards to the northern states.—The form in cult., described here, is probably *P. capsicifolia*, Dun., now regarded by some as a form of the cosmopolitan *P. angulata*. The writer prefers, however, to refer the plant to *P. ixocarpa* as outlined in Britton & Brown, although there is doubt as to the identity of the cult. plant with this species. Although the cult. plant is sometimes sold as *P. edulis* (erroneously), the fruits are usually too mawkish to be eaten from the hand (at least as grown in the N.). It is a very vigorous and productive plant and is of some consequence as an ornamental, but it is too weedy to be of much value. The fr. is larger than in the native *P. angulata*. The plant figured by Carrière as *P. violacea* (R.H. 1882:216) is the one here described. In Mexico, the fruits are said to be used in the making of chilli sauce and as a dressing for meats, usually under the name of "tomatoes." The Mexican forms are confused.

BB. *Stems pubescent or hairy.*

pubéscens, Linn. STRAWBERRY TOMATO of vegetable gardens. DWARF CAPE GOOSEBERRY. HUSK TOMATO. GROUND CHERRY. Fig. 1775. Low, trailing flat on the ground, or sometimes ascending to the height of a foot: lvs. rather thin and nearly smooth, more or less regularly and prominently notched with blunt teeth: fls. small (⅜ in. or less long), bell-shaped, the limb or border erect and whitish yellow, the throat marked with 5 large brown spots; anthers yellow: husk smooth or nearly so, thin and paper-like, prominently 5-angled and somewhat larger than the small, yellow, sweetish and not glutinous fruit. N. Y. to the tropics.—The plant is very prolific, and the fruits are considerably earlier than in the other species. When ripe the fruits fall, and if the season is ordinarily dry they will often keep in good condition upon the ground for 3 or 4 weeks. The fruits will keep nearly all winter if put away in the husks in a dry chamber. They are sweet and pleasant, with a little acid, and they are considerably used for preserves, and sometimes for sauce. The plant is worthy a place in every home garden. It is grown more or less by small gardeners near the large cities, and the fruits are often seen in the winter markets. The chief objection to the plant is its prostrate habit of growth, which demands a large amount of ground for its cultivation. In good soil it will spread 4 feet in all directions if not headed in. The plants are set in rows 3 or 4 feet apart and 2 or 3 feet apart in the row. This Physalis has been long in cultivation. It was figured by Dillenius in 1774, in his account of the plants growing in Dr. Sherard's garden at Eltham, England. In 1781–6 it was figured by Jacquin, and by him called *Physalis Barbadensis*, from the island of Barbadoes, whence it was supposed to have come into cultivation. In 1807, Martyn also described it under the name of Barbadoes Winter Cherry, or *Physalis Barbadensis*, and says that it is a native of Barbadoes. None of these authors say anything about its culinary uses. Dunal, in 1852, described it as var. *Barbadensis* of *Physalis hirsuta*, but later botanists unite Dunal's *P. hirsuta* with Linnæus' *P. pubescens*, of which this common Husk Tomato is but a cultivated form.



1776. Physalis Peruviana (fruits × ½).

Peruviàna, Linn. (*P. édulis*, Sims). CAPE GOOSEBERRY. Fig. 1776. As compared with *P. pubescens*, this is a much stronger grower, the plant standing partially erect and attaining a height of 1½–3 ft.: lvs. thicker, less regularly toothed, more pointed, heart-shaped at the base, and very pubescent or fuzzy: fls. larger (½ or ⅝ in. long), open-bell-shaped, the limb or border widely spreading and light yellow, the interior or throat blotched and veined with 5 purple spots, the anthers blue-purple: husk thicker and larger than in the last, somewhat hairy, and has a much longer point. Tropics. B.M. 1068.—This species is too late for the northern states. The berry is yellow, not glutinous, and much like that of *P. pubescens* in appearance, but it seems to be less sweet than of that species. This plant has been cultivated for two centuries, probably. It was described and figured by Morison in 1715 in England. In 1725 Feuillée gave a description of its cultivation in Peru, saying that it was then cultivated with care and was greatly esteemed as a preserve. The particular form of the species cultivated in our gardens is that which was described and figured by Sims in 1807 as *Physalis edulis*, the "edible Physalis." Sims' account says that "this plant is a native of Peru and Chili, but is cultivated at the Cape of Good Hope, in some parts of the East Indies, and more especially at the English settlement of New South Wales, at which latter place it is known by the name of the Cape Gooseberry, and is the chief fruit the colonists at present possess; is eaten raw, or made into pies, puddings or preserves." The plant is rarely sold by American seedsmen.

P. lobàta offered by dealers is not known to the writer. It is advertised as one of the Ground or Winter Cherries, with violet fruit. It is probably not P. lobata, Torr. Perhaps a form of the cultivated P. ixocarpa.—*P. Philadélphica*, Lam., a native species, is said by Britton & Brown to have been "formerly cultivated for its fruit." L. H. B.

PHYSIÁNTHUS (Greek, *bladder flower;* referring to the base of the corolla-tube). *Asclepiadàceæ*. This genus was long ago referred to Araujia, but the plants are still known to our trade under the names of Physianthus and Schubertia. Araujia is a genus of about 13 species of shrubby twiners from the American tropics, closely resembling in superficial characters the popular Stephanotis, having the same large white waxy fragrant 5-lobed fls. *A. graveolens*, in particular, has been suggested as a rival to the Stephanotis, especially as it requires less winter heat, but its foliage when bruised emits a strong and offensive odor, especially with young plants. *A. sericofera* has considerably smaller fls. and is one of several plants advertised as "Cruel Plants," because they entrap insects, though they may not digest their dead bodies as in the case of Nepenthes. These Cruel Plants are mostly members of the milkweed and dogbane families, which have essentially the same kind of floral structure—a highly complicated and specialized type adapted to cross-fertilization by insects. In Fig. 149 of this work, an insect is seen struggling in the clutch of a common milkweed, with a pair of pollen-masses hung over one of his hind legs like saddle-bags. *Araujia sericofera* catches moths in a slightly different fashion. See G. C. III. 20:523. For other "Cruel Plants," see *Cynanchum* and *Vincetoxicum*.

When well grown, Araujias bloom freely throughout Sept. and Oct. They seem to have no special soil requirements and may be flowered outdoors from seed sown indoors in early spring, or they may be kept permanently in a cool greenhouse and grown from cuttings. It is seldom that we see *A. graveolens* grown well in greenhouses, the plants being usually sickly and infested with mealy bug. As a summer vine in the open it makes vigorous growth, and after midsummer it usually blooms profusely. The fls. are larger than those of Stephanotis. Cuttings make the best flowering vines. These may be taken from the ripe wood before cool weather. Seeds are freely produced, and germinate well soon after being sown. Araujias are considered hardy in the most favored parts of England, and are grown outdoors in Calif. *A. graveolens* can be flowered in pots, but the border of the greenhouse is better.

There are about 13 species of Araujia, all with opposite lvs. and whitish or rosy fls.: corolla-tube short or long, inflated at the base; lobes 5, very wide or narrow, overlapping toward the right in the bud; crown with

5 scales attached to the middle of the tube or lower, flat and erect or convex and appressed to the staminal tube: seeds long, bearded. Schubertia and Physianthus should perhaps be considered as subgenera, the former containing the hairy plants with somewhat funnel-shaped fls.; the latter nearly glabrous plants with somewhat salver-shaped fls.

A. *Fls. 2–2½ in. across, umbellate.*

Araùjia gravèolens, Masters (*Physiánthus gravèolens,* Hort. *P. auricomus,* R. Grah. *Schubértia gravèolens,* Lindl. *S. grandiflòra,* Mart.). Densely covered with harsh, spreading yellow hairs: lvs. 3–4½ x 2–2¾ in., obovate, acuminate, greatly narrowed and cordate at the base, hairy on both sides: fls. funnel-shaped, i. e., swelled at the throat. S. Brazil. B.M. 3891. B.R. 32:21. G.F. 3:369. G.C. III. 4:271. Gn. 32:607. A.G. 13:695.

AA. *Fls. 1 in. across, cymose.*

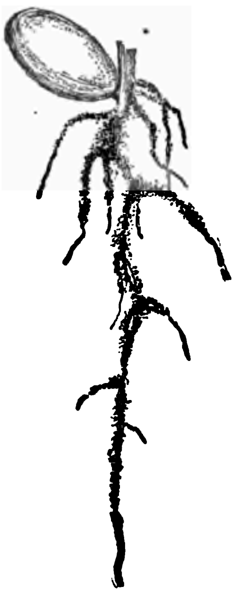
Araùjia sericófera, Brot. (*A. álbens,* G. Don. *A. sericifera,* Ind. Kew. *Araùjia sericófera,* Mottet. *Physiánthus álbens,* Mart.). Nearly glabrous: lvs. 3 x 1¾ in., oblong-acuminate, wide and square at the base, minutely pubescent below: fls. salver-shaped, i. e., not swelled at the throat, pale rose in the bud and only faintly odorous. S. Brazil. B.M. 3201. B.R. 21: 1759. G.C. III. 2:653; 20:523. R.H. 1857, p. 89; 1883, p. 488. Gn. 24, p. 409; 34, p. 397. Mn. 6, p. 206.—The plant as above described is the *Physianthus albens* or *Araujia albens* of the trade.

G. W. OLIVER and W. M.

PHYSIC NUT, FRENCH. *Jatropha Curcas.*

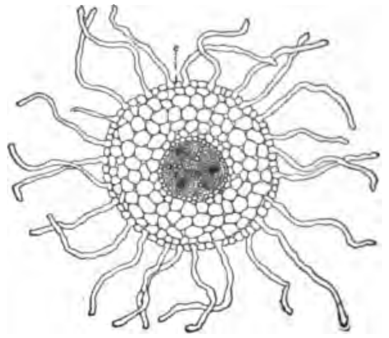
PHYSIOLOGY OF PLANTS. *What Plant Physiology Means.*—The very fact of cultivating plants presupposes some knowledge of how the plant lives, i. e., of plant physiology. The pristine cultivator sought to imitate nature, and by a system of selection and in favoring by cultivation the few plants which seemed best suited to his wants, he really improved and developed what he demanded for use. Thus with but little knowledge of how the plant lives, improvement in definite directions has gone forward from the earliest times. Nevertheless, the limitations in improvement have been regulated rather by limitations in man's knowledge of plant-life than by any lack of capacity for development in the plant itself. Every new discovery in plant physiology must eventually be of value to the horticulturist in one way or another, and the fundamentals of physiology are of prime importance.

A study of plant-life in field and garden alone would hardly have given foundation for plant physiology as a science. With a knowledge of the intimate structure of the plant the experimental method must be applied both in the field and in the laboratory. Neither actions nor processes can be intimately known unless the separate activities are in some way isolated and each for itself investigated by a study of cause and effect. From the germination of the seed, and the interesting changes which this involves, through all of the intricate living processes of breathing, taking in of food, digestion and assimilation of food material, and the formation of new plant substance, we have the plant living, the plant in action. Similarly, as a sensitive organism, it is to be studied as acted upon by all of the external conditions about it, and as responsive to every change of environment. In the broader sense of the term, physiology is a study of this living, sensitive, adaptable, reproductive plant.



1777. Root system of squash plantlet showing adherence of soil particles.

Every living process and every change produced by season or other condition has its charm and interest if the underlying principles are understood. A knowledge of these broadens the sympathies for the general observer of plants and gives the reflective cultivator a truer appreciation of the buoyant living organism with which he deals.



1778. Cross-section of rootlet showing root-hairs.

The Functions of Organs Differ.—Root, stem, leaf and flower are definite organs or parts of the common cultivated plant, and as distinct organs each of these has definite physiological functions, more or less peculiar to itself. The root of the soil, bog, water, or epiphytic plant has in each case peculiarities and modifications of structure, permitting it to do best the slightly differing functions which each is called upon to perform. In the same way there are variations in the requirements of leaf, stem and other parts commensurate with the conditions of growth and the functions of the parts in their relations to external conditions.

Desert vegetation consists generally of very curiously modified plants. There are, in general, wonderfully thickened and reduced green stems. Many of these plants may store up large quantities of food in their stems, and in some a large supply of water may be stored to tide the plant over long periods of drought. Except in the novel interest afforded, these modifications are more or less meaningless unless it is remembered that here physiological conditions have been seriously modified, and the plants have met their needs in the most serious way. As compared with other vegetation, structure has here been violently subordinated to function.

Oxygen Supply and Respiration.—Even the plant of ordinary culture is not such a dependent organism as its lack of general locomotion would imply. It lives, moves and works every day. In every living process work is accomplished. There is work in maintaining the rigidity of its structure, in absorbing food material, in supporting and accomplishing the various complex internal processes of assimilation, growth, and development. The forcing of its roots through the soil and rock, and the resistance to the stress of winds and other agencies are examples of the energy daily expended in maintaining itself. In order to accomplish this work, oxygen is necessary, as with the animal, the energy being secured from the breaking down of organic compounds. Ordinarily, the leaf and stem are bathed in the atmosphere, and so the superficial presence of oxygen is always assured. By the leaves and green stems oxygen is absorbed mainly through pores (called stomates, or stomata) in the epidermis. The stem may also secure a further supply through certain corky cushions known as lenticels, found abundantly in sumac, walnut, elder, etc. Roots also require a constant supply of oxygen, and terrestrial or soil roots suffer greatly if deprived of it for short periods of time. A field of Indian corn flooded with water will soon present a very unhealthy appearance, on account of the fact that water forces the air out of the soil. Cultivation is in part a means of aërating the roots. Many greenhouse difficulties are directly traceable to over-watering, or "cold feet," the effect of too much water being partially to prevent aëration. Water plants have adapted themselves to getting oxygen in other ways, and many bog plants send to the surface special roots for aërating purposes.

No plant can live without oxygen. In some way or other oxygen must be secured. The more active a plant is, whether in growth or in movement, the more oxygen will it require. Even dry seeds must respire slightly, and in some kinds respiration may be so rapid that after a single season death may ensue. This use of oxygen, whether by the germinating seed or by the growing or assimilating part, is accompanied by the giving off of carbon dioxid, or foul gas. This whole process is respiration; and in its ultimate effects it is similar to respiration in animals.

The Role of Water in the Plant.—Even quicker to manifest itself than the action of suffocation by lack of oxygen is the injury which most plants may suffer from an insufficiency of water. The rigidity of an herbaceous or succulent plant is due largely to its water content; and without a substantial degree of this rigidity, growth would cease and life soon become extinct. The plant pulled up by its roots or cut down, wilts almost immediately. The wilting of plants, then, is due to a lack or loss of water supply.

The way in which the ordinary plant may constantly obtain a quantity of water from the soil is worthy of full discussion. On pulling from the soil a growing plantlet of squash, we find a tap-root and a number of small rootlets. To the latter cling, perhaps, small particles of the soil, as in Fig. 1777. If, however, seeds are germinated between pieces of moist paper or cloth so that there will be no disturbance of the delicate growing parts, further structures will be evident. From a quarter of an inch or so behind the root-tip, and extending backward for a considerable distance, the rootlets are clothed with numerous delicate hairs (shown in Figs. 1778 and 1788). These are the root-hairs, and it was to such as these that the soil clung in Fig. 1777. They are simple, long, tube-like cells consisting of a cell wall with living protoplasm and cell sap. The inner protoplasmic lining of this cell wall permits water and salts in solution to pass inward by the interesting process of osmosis.

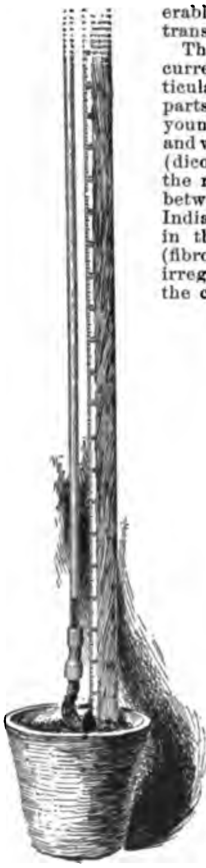
The root-hairs are temporary structures which never grow into rootlets, but which die away as the roots become old or woody. While living they perform the important function of absorbing from the soil nearly all of the water needed by the plant. Being numerous and extremely delicate, they come into the closest touch with the surface film of water adhering to the little particles of soil, and from such film water they more readily satisfy their needs than from free soil water. They can extract water until the soil contains only a very small per cent, or until it is dust-dry.

The root-hairs absorb water freely, and during active growth it is forced upward into root and stem so vigorously that a pressure (root pressure) of considerable extent may be manifest. If the plant be severed and a tube applied to the stump, this pressure manifests itself by lifting a column of the liquid absorbed, and often to a considerable height. In any herbaceous plant it may be tested, as in Fig. 1779. In the grape vine 36 ft. of water may be maintained. The bleeding of plants is an evidence of root pressure.

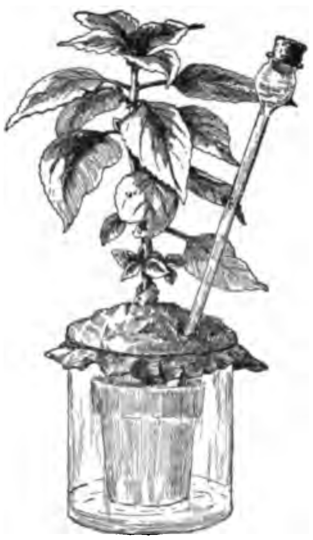
Water is actually absorbed in much greater quantity than is required merely as a constituent of the plant body. In fact, to form one ounce of plant substance it is estimated that 15–25 pounds of water must pass through the plant. This surplus water passes off through the leaves and other succulent parts, principally through the stomata previously mentioned. This process is one of evaporation from living membranes, and it is called transpiration. That transpiration is not merely an evaporation process may be roughly shown by an experiment with two similar leafy branches freshly severed. One of these is dipped in hot water to kill the protoplasm, then the two are left to dry out. Transpiration from the living twig will be less rapid than evaporation from the dead one. The demonstration of transpiration is an easy matter. A leafy branch of any plant may be cut off and the end inserted through a bored cork into a bottle of water. Over the whole may be placed a larger jar or bell-glass, and in a short time a mist will collect on the inside walls of the latter. Transpiration is facilitated by dry air, wind, high temperatures, movement of the plant, etc. If on a hot day or in dry weather transpiration is greater than the amount of water absorbed by the roots, the plant wilts. A very slight shower will refresh a wilted plant, but not because the leaves have absorbed water. The plant recovers because the air is saturated, and transpiration is thereby so much lessened that the roots can catch up in furnishing the necessary supply.

Fully a quart of water is daily transpired from a forming cabbage head, and the number of tons of water daily given off per acre by forest or even meadow-land may reach an astonishing figure. The amount of water transpired by a small potted plant may be readily weighed. Place the pot in a glass jar as seen in Fig. 1780, tying over the top and snugly around the plant some soft rubber cloth. Water the plant through the glass tube and then weigh. After standing 6 or 12 hours in a dry atmosphere the weight will be considerably reduced, due to the loss by transpiration.

The path of the ascending water current or sap current is through particular vessels of the young woody parts. In trees it ascends in the youngest wood rings, not between bark and wood. In herbaceous netted-veined (dicotyledonous) plants the path is in the ring of woody tissue or bundles between the bark and pith. In the Indian corn (monocotyledonous) it is in the thread-like groups of fibers (fibrovascular bundles) scattered rather irregularly throughout the pith. That the current is always through these woody bundles in the above plants may be demonstrated by placing branches of the plants in a tumbler containing some eosin solution. In a few hours the bundles will be colored for a considerable extent. The current will rise much faster if the branch to be used is cut under water. This prevents the access of air and the partial stoppage of the conducting channels. For the same reason flowers wilt less rapidly when the stems are cut under water.



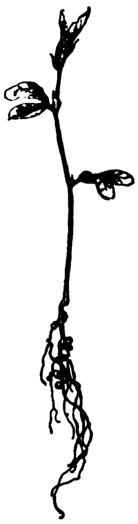
1779. To test root pressure.



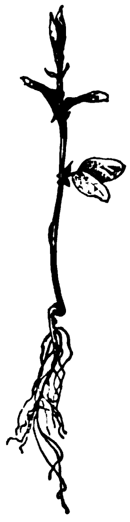
1780. Experiment to determine the amount of water transpired.

The total amount of water in plants varies from a very small percentage in dry seeds to about 50 per cent in green wood, and often as much as 95 per cent in the pumpkin.

The Food Supply of Salts from the Soil.—Besides securing from the soil its water supply, the plant must secure in the same way all of its ash constituents, and usually all of its nitrogen, as soluble salts. The salts furnishing food are such well-known food ingredients, or constituents of fertilizers, as potash compounds, phosphates, nitrates, etc. The various mineral elements generally necessary for the plant are potassium, phosphorus, sulfur, calcium, magnesium, and iron in small quantities. These, as well as other inessential elements, are the constituents that remain in the form of ash when the plant is burned in air. That each one of these elements, as well as nitrogen, is necessary for the full development of the higher plant has been repeatedly demonstrated. For this demonstration seedlings are supported and grown in jars containing culture solutions. One or more of the above elements may be left out in certain cases to be compared with one in which all are present, and it will then be found that growth and development will soon be arrested where even one necessary element is entirely absent.



1781. Sweet pea grown in soil containing the tubercle-forming organism.



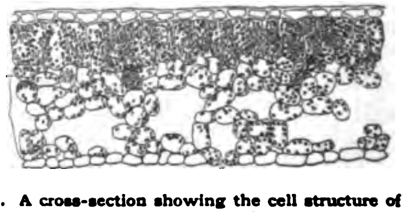
1782. A similar plant in a soil freed from the tubercle bacteria.

Nitrogen Sometimes Furnished by the Air.—Plants ordinarily get their nitrogen from the soil as nitrate of soda, saltpeter, or other soluble salts. This is the rule, and although the air contains about 75 per cent by weight of the free gas nitrogen, it is in this form entirely inert to most plants. Leguminous plants (Leguminosæ) form a great exception to this rule. On the roots of such plants are found swellings or tubercles, as in Fig. 1781, caused by the growth of parasitic bacteria. By the aid of these bacteria, the plant is able to appropriate the free nitrogen of the atmosphere and to thrive in a soil almost free of nitrates. This has been demonstrated repeatedly with plants in sand or water cultures. Utilizing the free nitrogen of the air, leguminous crops, whether used as green manure or not, restore the land by returning to it more nitrogen than is taken away. They necessarily enter into any thorough system of rotation upon weak lands, and represent an important economic factor in horticulture, particularly in orchard culture.

The Association of Roots with Fungi.—Other plants are also aided by an association of the root with certain filamentous fungi. In connection with the roots of the oak, beech and other woody as well as herbaceous plants, this association of root and fungus (termed mycorhiza) is of much aid in the absorption of solutions from the soil. In such cases it is thought that the fullest development of the plant is dependent upon the presence of the fungus.

The Formation of Organic Substance.—Next to the elements of water (hydrogen and oxygen) carbon forms the bulk of the plant substance. It is a constituent of all starchy, sugary or nitrogenous (organic) products, and of all woody fiber. It is, in fact, the element whose presence indicates organic substances. When plants are burned in an atmosphere more or less devoid of oxygen, the bulk of the remaining charcoal is pure carbon, for the ash present would be so small in volume that it might be neglected. The ordinary green plant obtains this carbon only from the carbon dioxid of the atmosphere. Carbon dioxid forms only .04 to .05 per cent by weight of the atmosphere, and in order to enter into the composition of the plant, it must first diffuse itself into the tissues of the leaves and other green parts. The leaf is so constructed that the diffusion of carbon dioxid readily takes place. Numerous stomata lead from the epidermal surfaces into the air spaces, which penetrate all parts of the leaf, as in Fig. 1783. By means of this system of communication, diffusion results, and the carbon dioxid is brought into contact with a large absorbing surface of living cells. Together with favorable growth conditions, however, the utilization of carbon dioxid depends upon the leaf-green (chlorophyll) and sunlight. The green chlorophyll absorbs a considerable part of the rays of sunlight, and by means of the energy thus provided carbon dioxid (CO_2) is forced to unite with a portion of the absorbed water (H_2O). The union of these substances is accomplished by an obscure process, but in such a way that eventually carbon and the elements of water (hydrogen and oxygen) are united in the form of a carbohydrate. This substance is first readily demonstrable as starch, —of the composition $C_6H_{10}O_5$. In this process of union, or synthesis, there is an excess of oxygen furnished, and it is this oxygen which is thrown off by the leaves. This process of uniting carbon dioxid and water under the influence of chlorophyll and sunlight in the living tissues is known as photosynthesis—a building up of higher substances by sunlight. The process is also called carbon dioxid assimilation. Photosynthesis and respiration are, in a way, reverse processes; in the former carbon dioxid is absorbed in sunlight and oxygen given off; in the latter, as previously noted, oxygen is constantly absorbed and carbon dioxid given off. However, the ordinary plant, as a whole, respires but feebly, while it assimilates carbon very rapidly in sunlight. The result is that by night a small amount of carbon dioxid is given off and by day a large amount of oxygen. See ***Photosynthesis.***

The starch made in sunlight and stored in the cells of the leaves is in the form of insoluble granules, like commercial starch. In order to be utilized by the protoplasm in growth, or in forming further plant substance, it must first be transformed, or digested. This is constantly taking place in the leaves by means of an enzyme called diastase. The diastase converts the starch to a soluble substance, a form of sugar, and this sugar may then be used immediately in building up more complex organic compounds used by the protoplasm, or the sugar may be transported to some storage organ of the plant, such as root (dahlia), stem (potato), or thickened leaf, and there be reconverted to starch or changed to some insoluble or more complex product. This translocation of the starch formed in the leaves by day may be so thoroughly effected during a single night that none will remain as starch by the next day.



1783. A cross-section showing the cell structure of a typical leaf.

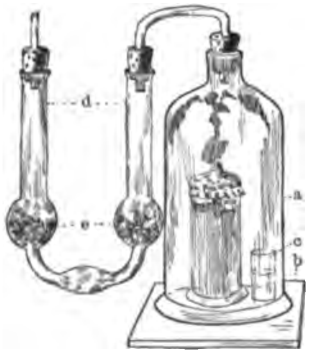
An unfailing test for starch is a blue or blue-black reaction on the addition of a weak solution of iodine. A bit of starch paste, or the cut surface of a potato or other starchy area, will quickly show this reaction. In green leaves starch may be tested by first dissolving out the chlorophyll in alcohol and then staining the leaf with iodine. In the same way one examines a leaf variegated with white. The green or colored parts of the leaf alone will show starch, the white areas showing no blue or purplish coloration, demonstrating that they have formed no starch.

It requires a glass apparatus, such as is shown in Fig. 1784, to demonstrate that a land plant cannot form starch in an atmosphere free of carbon dioxid. Over a small potted plant (or better, the plant may be transplanted to a glass jar protected at the top by rubber cloth) is placed the vessel *a*, cemented to the glass plate, *b*. A solution of caustic potash in *c* absorbs the carbon dioxid in the vessel, and all air admitted must pass through the U-tube *d*, which contains at *e* pumice stone soaked with caustic potash. This plant exposed to direct sunshine for a few days will show no starch formation on testing its leaves. In a short time it will also become unhealthy and cease to grow.

Not only does chlorophyll act in conjunction with sunlight for the manufacture of starch; but, in general, sunlight is absolutely necessary in order that chlorophyll may be normally developed. Seeds germinated in a darkened vessel or potato sprouts which have pushed into growth in a darkened cellar will remain yellow or white. Moreover, the plants will grow long and slender, and death will result when the plantlet can no longer draw upon the parent part for starchy matters. The total dry weight of such plants will not be greater than the dry weight of the original seed or tuber. In this connection it might be stated that fern spores require some light in order that germination may occur, while the germination of ordinary flowering plants is slightly retarded in the presence of light.

The sugar into which starch is converted for translocation is abundant in the leaves; and it is also transferred to all living parts of the plant, along with other organic products, besides the various salts in solution which have come up to the leaves from the soil. Under the influence of the active protoplasm of the leaf-cells or of other tissues, more complex compounds necessary in growth may be formed. All parts of the ordinary plant are dependent upon the roots for a supply of the mineral salts and nitrogen; but, on the other hand, they are entirely dependent upon the leaves for the first organic substance, and for much prepared food.

Growth, and the Differentiation of Structure.—Plant growth is apparent to the unaided eye as change in form and size of organs and tissues. The real evidence of growth is in the multiplication of the tissue cells, or of constructive changes in the form and bulk of these cells. Growth may be so rapid that it may be readily measured, or it may proceed so slowly or by such obscure internal modifications that very little external indication of the complex processes will be manifest. Even under such adverse conditions as that of deciduous trees in winter, some slight growth may be taking place, and it is not well to dissociate from the idea of a living plant all growth phenomena. Nevertheless seeds and other air-dried plant parts may live without growth for considerable periods.



1784. An apparatus for demonstrating that plants cannot form starch in the absence of carbon dioxid.

The growth in size and length of different plant organs is very various. The zone of growth in the root is just back of the tip, so that if an ink mark be made immediately behind the tip and another a quarter of an inch further back, almost the entire growth extension of the root will take place within the region thus marked. There is no growth in the very tip, because it is hard and protected by a stout cap to aid in forcing its way through the soil and around hard obstacles. The region of greatest cell division is nearer the tip than the region of greatest elongation. On the other hand, the young stems of annual plants and the rapid elongation of the young shoot may for a time show growth throughout the entire extent. The winter condition of a beech twig is shown in Fig. 1785, and the long, delicate, overlapping scales of the buds are very evident. Each bud is an incipient branch, as is readily seen in the spring when the buds elongate; the delicate scales separate farther and farther from one another, each bearing a little leaf in its axil, and marking a now distinct joint or node in the new branch. Various stages of this general elongation are evident from Fig. 1786. Finally as the branch lengthens throughout its entire extent, the scales drop, the leaves expand, the older nodes cease to elongate, and the wave of elongation follows a few nodes behind the terminal bud.

1785. A beech twig in winter condition.

1786. A similar twig when growth has begun in the spring.

In the common woody plants growth in diameter is accomplished by means of a distinct but thin layer of tissue functioning as the zone of cell division, or cambium. The cambium is located just between the wood and bark. In fact, it divides a complete ring of fibrovascular bundles into an inner or woody portion (xylem) and an outer or bast and sieve-tube portion (phloem). Each year it gives rise on the inner side to a layer of wood and on the outer side to a layer of bark, thus each year covering up and pushing to the center, as it were, the old wood, and pushing outward the old bark as a protective covering. By this process the inner wood retains its former dimensions, but the bark must constantly expand to cover the increasing diameter of the tree, and so it breaks into rifts and ridges of various forms, or else peels off periodically. The differentiation of the tissues in different parts denotes different physiological functions. Thus the woody part of the young rings conducts the water and other soil foods, and through the woody bundles of the leaf-stalk, veins, and veinlets it is distributed throughout the plant body. The bark or phloem portion of the bundles is largely concerned in the conduction of the digested or leaf-formed foods to other parts.

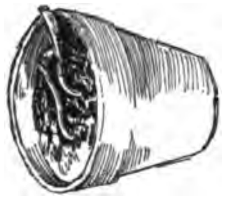
Seed Production.—So far as we know, the ultimate function of a plant in nature is to produce seeds or to reproduce its kind. It matters not how far the horticulturist may have diverted this natural function in particular instances, in general the sum of the physiological activities is directed to seed-production. Much energy is directed to the development of form and color in the flower, also of fragrance and odor, and there are deep-seated physiological processes connected with pollen and ovule production, with pollination, fertilization (see p. 579), and the subsequent development of the seed.

Seeds are, as a rule, richer in nitrogenous matter than other parts of the plant. Likewise, in phosphorus and magnesium salts there is a marked increase in the seed. Of these last-named substances, there is a migration, as it were, from the older parts to the region of seed formation, and finally to the seed. On the other hand, the salts of lime gradually increase in quantity in the older tissues, particularly in the old assimilatory tissues.

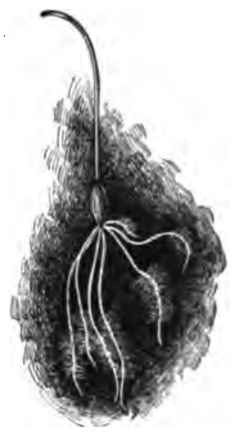
The Living Protoplasm the Seat of Vital Action.—Physiological activities cannot be thoroughly studied by the use of the plant as a whole or by the use of the organs as particular parts of a complex whole. The final seat of all the plant activities resides in the living protoplasm of the cells composing the plant. Except as serving purely mechanical purposes, the old heart wood and bark of trees are inactive, and they contain no living substance. They are made merely of the hardened walls of cells which once constituted living parts. The actual living parts, such as the leaves, buds, flowers, fruits, and young wood, are composed of living cells. The most essential part of a living cell is the protoplasm, a semi-fluid, viscid substance which constitutes the living material in all organisms. A definite layer of the protoplasm surrounds the inner surface of the cell wall, and protoplasmic strands radiate throughout the cell, in which is also differentiated a denser and absolutely essential part termed the nucleus. In addition the cell contains an abundance of cell sap, or water, holding in solution certain food substances. The cell wall is a mechanical support, and as a physiological agent it is quite dependent upon the protoplasm. In conjunction with the wall layer of protoplasm, the cell sap absorbs water osmotically from weaker solutions outside, and by the same process solutions are passed from cell to cell and diffused throughout the growing parts. When transpiration is proceeding it is some of this water of the cell sap which is given off through the leaves into the air. As a result of this loss of water the protoplasm contracts away from the cell wall and the rigidity (turgor) of the cell is lost. Thus the cells and the tissues lose strength, and the plant becomes flaccid and wilted.

It is by means of the chlorophyll, but it is not the chlorophyll alone which has to do with the formation of starch from carbon dioxid. The chlorophyll is imbedded in the living substance, forming definite chlorophyll bodies; and it is only when associated with living matter that it can perform its functions.

The Plant is Affected by External Conditions: It is Irritable.—When a seed is put to germinate, the first requisite is that it shall imbibe water and swell. Oxygen is at hand, and if the necessary temperature prevails the protoplasm is awakened to activity, and new growth is incited. The protoplasm increases in bulk in existing cells, and then cell division begins. At first the embryo draws upon the seed for its food supply, and is able to establish itself in the soil. A differentiation into tissues and organs having different functions has already occurred. Moreover, as soon as growth begins, the influences of external agencies assert themselves. The first shoot does not wander about in the soil, but, directly against the force of gravity (negatively attracted), it directs itself upward. In an exactly contrary manner, the first root attracted by the stimulus of gravity (positively attracted) directs itself downward. Only the overthrow or overbalancing of gravity by some superior stimulus can prevent this reaction. If a pot containing a seedling be placed upon its side, the stem will actually curve when some growth has already occurred, bending itself directly upward, as shown in Fig. 1787. The root will form a curve in its growth, and again grow downward. The response of growing organs to the stimulus of gravity is called geotropism. Geotropism acts upon the active growing part and by means of the living protoplasm.



1787.
Negative geotropism of the young stem.



1788. Young seedling showing root-hairs, and also stem bending towards the light.

The relation of the plant to light, or the light stimulus, is one of the most pronounced phenomena in nature. In a dark chamber young shoots will direct themselves or grow directly toward light admitted through a small slit. Note how the seedling bends toward the light in Fig. 1788. If exposed, the roots would direct themselves in a contrary manner. Even the mature leaves of all plants will turn or lean toward the source of light. This may be well observed outside when the sun is low, and at any time of day with a window garden. An interesting case of the response to light is to be found in the wild lettuce (*Lactuca Scariola*), which is known as a compass plant. In sunlight this plant holds its leaves in a vertical plane, one row of leaves pointing north and the other south. This provision may be to avoid the full rays of the midday sun, and yet to secure the best advantage of the less intense forenoon and afternoon sunshine. The response of plant organs to the stimulus of light is known as heliotropism.

In the same way plant organs will be stimulated to grow towards or away from air (aerotropism), a certain degree of moisture (hydrotropism), a definite temperature (thermotropism), nutrient substances or other chemical agents (chemotropism) mechanical irritation (thigmotropism) and other stimuli. In all of these ways the plant is active and irritable. In all cases it is the active protoplasm which is concerned in determining the nature of the response.

Temperature has a marked effect upon all living processes and it deserves particular mention. It may limit either by too great heat or too intense cold each of the particular vital activities. There are three critical temperatures for growth, a maximum or higher temperature, a minimum or lower temperature beyond which on either side no growth takes place, and the optimum, or that intermediate grade which brings to the best development all of the faculties of the plant. Sometimes the optimum as reckoned by the amount of growth would not correspond to the optimum for flower or seed production, a fact well recognized in greenhouse culture. The growth optimum may also be a temperature at which the plant is more readily attacked by parasitic diseases. Particular varieties or species vary greatly as to their susceptibility to disease at different temperatures. Often it is of more value to know the temperature at which the general sanitary conditions for a plant are an optimum, rather than to know the optimum for growth alone. The absorption of water by the root-hairs, the manufacture of starch by the leaves, transpiration, and other processes are to a large extent dependent upon the temperature. Hot, dry winds of the summer-time often cause serious injury to trees, owing to the rapid transpiration from the leaves. In dry seasons this is very likely to occur with the Norway maple. Fig. 1789 represents an injury of this kind. As a rule, the leaves on that side of the tree from which the wind comes are much more injured than others.

The annual fall of the leaf in deciduous trees is usually a matter of temperature, although drought and other conditions may also cause periodic defoliation. It would cost much labor to protect the large green surfaces during the winter and it is economy to part with a portion of the structure. The cool days of autumn chill the root-hairs and irritate the assimilatory organs. The former cease to perform their normal absorptive functions, and from the leaf are gradually withdrawn the substances which are readily made soluble. The cell walls and the less useful parts are left, and by the formation of a distinct corky layer across the leaf-stalk, where it is attached to the main stem, the plant cuts off its assimilatory organs by a natural process, so that no wound or injury except the well-healed leaf-scar shall mark its fall. In this process the chlorophyll is oxidized and changes from green to some other color, as yellow or red; and often it is by this means that the beautiful autumn colors are developed. These colors also serve very likely as a protection to shield twigs and trunks from the hot autumn sunshine. Likewise, the twigs themselves may be provided with color for the same purpose.

1789. A cluster of leaves of the Norway maple injured by hot winds.

The old leaves are dropped in the autumn, but already a new set of modified leaves in the form of bud-scales have been formed, in turn to be defoliated the next spring, after serving a term of winter protection. Deciduous trees then shed their summer leaves when growth ceases and their winter leaves when growth is awakened.

Plants such as the squash and potato may be killed by a degree of cold less than the freezing point. It is because the protoplasm of the cells is stimulated to give up its water into the spaces between the cells, and then not being held by the protoplasm, this water is readily evaporated and the plant dies from being dried out. In the same way a plant may wilt and eventually be much injured if cold water is applied to its roots. In general, freezing consists in the drying out of the protoplasm and the formation of ice crystals between the cells. The plant may recover if the protoplasm can gradually reabsorb this water: it will die if the water is not reabsorbed.

The effect of temperature upon orders and species of plants is very evident in the differing character of the vegetation in different life zones. Temperature is not alone the cause of the difference, but it is the principal factor. In the tropics succulent plants predominate, and gigantic leaf surfaces abound as accommodation to the great moisture content of air and soil. In the temperate regions there is a degree of heat encouraging perfection of size in woody development coupled with a considerable luxuriance of foliage, as well as a large development of herbaceous plants. In arctic regions the more succulent green growth is entirely suppressed, in general smaller woody forms abound, and even the texture of leaves and fruit is expressive of hardiness.

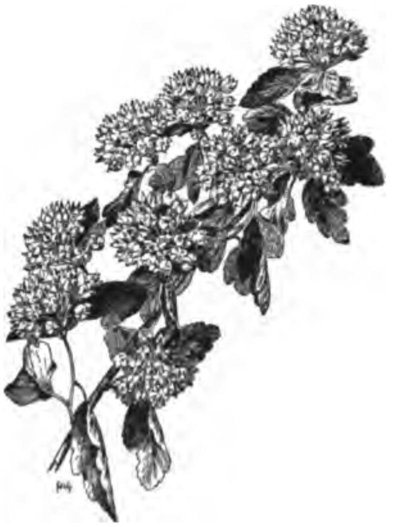
Plants along the seacoast differ from those farther inland, the salt spray having a very injurious effect upon those which have not become resistant to it. Around the edges of ponds and lakes there is a struggle for position, and as a rule the differing capacities of the plants to thrive in differing depths of water, or degrees of moisture, cause them to be arranged in definite colonies or zones.

The sum of the responses to these and other stimuli determine the form and character of the plant, and determine whether it shall very closely resemble its ancestors, or whether it shall have characteristics varying slightly from them. From the same parent a dandelion of the mountain-side will differ somewhat from the dandelion of the lowland meadow. External agents, under which category cultivation is an important factor with domesticated plants, act not only slightly to change individuals, but in time to change varieties and species. Working from one generation to another, in conjunction with natural or artificial selection, external agencies develop new forms and habits as the plant adapts itself more perfectly to these conditions. In this way plants vary as individuals, and in time as races or species. These variations are but slight from one generation to another, but it is safe to say that there are few cultivated plants to-day which resemble exactly their ancestors of the Linnæan times.

Literature.—Among works upon plant physiology may be mentioned Sorauer's "A Treatise on the Physiology of Plants," translated by Weiss (Longmans, Green & Co.); Detmer's "Practical Plant Physiology," translated by Moor (The Macmillan Company); and Pfeffer's "Physiology of Plants," translated by Ewart (Clarendon Press). The first mentioned is intended for the use of gardeners, and the others are technical treatises. Such books as "Living Plants and Their Properties," by Arthur & MacDougal; "The Survival of the Unlike," by L. H. Bailey; "A Theory of Horticulture," by Lindley; "Plant Relations," by J. M. Coulter; and other similar works may be consulted with much profit.

B. M. DUGGAR.

PHYSOCÁRPUS (Greek, *physa*, bladder, and *karpos*, fruit; alluding to the inflated capsules). Syn., *Opulaster*. *Rosaceæ*, tribe *Spiræeæ*. NINEBARK. Hardy ornamental deciduous shrubs, of spreading or erect habit, with stipulate, alternate, petiolate and mostly 3-lobed lvs. and with umbel-like heads of whitish fls. appearing late in spring, terminal on short branchlets along the stems and followed by clusters of small pods, inflated in some species and often assuming a bright red color late in summer. They are well adapted for shrubberies and grow in almost any soil. Prop. easily by either hardwood or greenwood cuttings, also by seeds. Five species in N. America and Amurland, allied to Spiræa and formerly mostly referred to this genus, but distin-



1790. Ninebark—Physocarpus opulifolius (× ¼).

guished by the stipulate lvs. and the often inflated pods dehiscent along both sutures and containing one or few shining yellowish seeds, the bark peeling off in thin strips. Also sometimes united with Neillia.

opulifòlius, Maxim. (*Spiræa opulifòlia*, Linn. *Opulàster opulifòlius*, Kuntze). NINEBARK. Fig. 1790. Shrub, to 10 ft. high, with wide-spreading and recurving branches: lvs. roundish ovate, usually cordate at the base, 3-lobed, with the lobes crenately dentate, 1–3 in. long, usually glabrous beneath: corymbs 1–2 in. broad, many-fld.: pedicels and calyx glabrous or pubescent: pods 3–5, inflated, much longer than calyx-lobes. June. Quebec to Ga., west to Manitoba and Kansas. B.B. 2:195.—Var. **lùtea**, Kirchn. (var. **aùrea**, Hort.). Lvs. bright yellow at first, changing to golden bronzy yellow. Var. **nàna**, Kirchn. Dwarf form with smaller, less lobed, dark green lvs.

Amurénsis, Maxim. (*Spiræa Amurénsis*, Maxim. *Opulàster Amurénsis*, Kuntze). Similar to the former, higher and of more vigorous growth: lvs. 3–5-lobed, with acute or acuminate, doubly serrate lobes, usually pubescent beneath, 2–5 in. long: fls. large, with grayish tomentose pedicels and calyx: pods tomentose, only one-third longer than calyx-lobes. June. Amurland.

P capitàtus, Kuntze (Spiræa capitata, Pursh. Opulaster capitatus, Kuntze. S. opulifolia, var. mollis, Torr. & Gray). Closely allied to O. opulifolia. To 20 ft.: lvs. somewhat larger, with serrate, more elongated lobes, tomentose beneath: pedicels and calyx tomentose. Ore. to Calif.—*P. malvàceus*, Kuntze. (O. pauciflorus, Heller. Neillia malvacea, Greene). To 5 ft.: lvs. slightly 3-lobed, with crenately and obtusely toothed lobes, usually pubescent: corymbs rather few-fld.: pods 2–3, not inflated, tomentose, about as long as sepals. Wyo., Idaho. B. M. 7758 (as Neillia Torreyi).—*P. monógynus*, Coult. (Opulaster monogynus, Kuntze. Spiræa monogyna, Torr. Neillia Torreyi, Wats.). Similar to the preceding, to 3 ft. high: lvs. smaller, ¾-1½ in. long, incisely 3-lobed, with incisely serrate lobes, usually glabrous: pods 1-2. Colo. to Calif. G.F. 2:5.

ALFRED REHDER.

PHYSOSTÈGIA (Greek, *bladder* and *covering;* referring to the inflated fruiting calyx). *Labiàtæ*. FALSE DRAGON-HEAD. Three or 4 species of hardy herbaceous perennials, native to America, with spikes of gaping fls. of purple, rose color or white. *P. Virginiana*, the dominant and most variable type, is frequent in gardens and is sometimes called the Obedient Plant because its corolla will stay for a while in whatever position it is turned, to the right or left. This plant and its varieties have had at least 7 colored plates devoted to them, a large number for any labiate. *P. Virginiana* is an elegant plant when well grown and it does best in a strong, rather moist, fertile soil. It forms large clumps 3–4 ft. high and blooms in July and Aug. Requires frequent division or replanting.

Generic characters: calyx bell-shaped, swollen and remaining open in fr., membranous, 10-nerved; teeth 5, equal; corolla 2-lipped, inflated above; upper lip concave, rounded, entire; lower lip 3-lobed, the middle lobe commonly notched; stamens 4, didynamous; anther cells parallel.

Virginiàna, Benth. (*P. Virgínica*, Hort.). Fls. an inch long, ranging from purplish red through rosy pink and lilac to white. B.M. 467. Mn. 7:81. F.R. 5:55. Var. **álba**, Hort., is a recent and beautiful white-fld. form. R.H. 1898:336.

Var. **speciòsa**, Gray, is a tall form with very acutely serrate lanceolate lvs. and dense-panicled spikes. A Texan form with erect, imbricated fls. B.M. 3386 (*P. imbricata*).

Var. **denticulàta**, Gray (*P. denticulàtum*, Ait.). A lower and more slender form with crenulate denticulate or obscurely serrate lvs. and more slender or loosely-fld. spikes. Middle Atlantic states. B.M. 214.

F. W. BARCLAY and W. M.

PHYSÙRUS (Greek, *bladder* and *tail;* from the purse or pouch-like spur). *Orchidàceæ*. A genus of about 20 species belonging to the category of Goodyera and Anœctochilus, and cult. for their foliage. Stem simple, erect, leafy: lvs. petiolate, ovate to lanceolate: fls. small, in a terminal raceme; petals and dorsal sepals cohering, galeate; lateral sepals free; labellum spurred, strongly concave above the entrance of the spur and abruptly contracted, middle lobe spreading or recurved; column short. Natives of the warm regions of Asia and Amer. The American species have their lvs. mostly spotted.

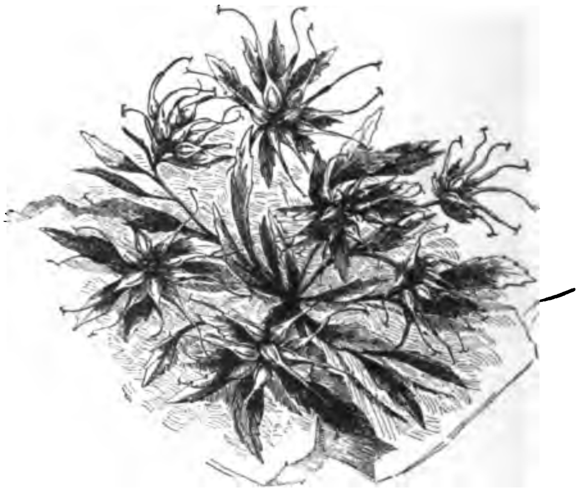
querceticola, Lindl. (*Goodyèra quercícola*, Chapm.). Stem ascending, 6–12 in. high: lvs. ovate or oblong-ovate, thin, on slender petioles, spotted with silver-gray: spike densely fld.: sepals and petals oblong, obtuse: labellum concave, ending in a broadly ovate, acuminate and recurved point; spur pouch-like. Aug. Low shady woods, Fla. and westward. HEINRICH HASSELBRING.

PHYTÉLEPHAS (Greek, *elephant plant;* referring to the hard white seeds which can be worked like ivory). *Palmàceæ*. Prostrate or ascending palms of doubtful relationship, referred by some authorities to *Pandanaceæ*. They are diœcious, the fls. densely crowded in catkin-like spadices, without any perianth: leaf-segments acuminate. Species 15. South America.

macrocárpa, Ruiz & Pav. IVORY-NUT PALM. Caudex low: lvs. very long, pinnate. Peru, Venezuela. Gn. 24, p. 468.—Once adv. by Pitcher & Manda. Furnishes the vegetable ivory of commerce. Sometimes called Negro's Head.

JARED G. SMITH.

PHYTEÙMA (old Greek name, meaning simply "a plant," used by Dioscorides for some mignonette-like herb). *Campanulàceæ*. HORNED RAMPION. Phyteumas are hardy herbaceous perennials, used for borders or alpine gardens. (See Figs. 1791, 1792.) The fls. are mostly shades of blue, more or less purple, rarely white. There are two styles of inflorescence, the globular and the long-and-narrow, the former being the more interesting. The showy feature of *P. comosum*, at first glance, seems to be a group of colored and much elongated pistils; but these pistil-like bodies are really corollas which usually show slits at their inflated base and are narrowed above into a very slender tube from which the style and stigmas are much exserted. In *P. comosum* the corolla never opens, but in all the others it finally splits at the top, making a spreading or wheel-shaped flower. The tubular stage seems the most attractive in the round-clustered species and the open stage, perhaps, in the oblong-clustered species. Phyteumas are natives of the Mediterranean region; about 50 species. These plants are little known in this country, but the following account is given because the plants are worthy and because the species are much confused amongst horticulturists. None of the species seem to be regularly in the American trade.



1791. Phyteuma comosum (× ⅓).
A tufted alpine plant growing in a crevice.

Phyteumas generally seed freely and may also be prop. by division, which is best performed in spring after growth begins. They thrive in ordinary garden soil in either border or rockery. A very critical review of Phyteumas from the garden standpoint is given by "D. K." in Gn. 28, pp. 91, 92 (1885), from which the following points are abstracted. The smallest species, as *P. humile* and *pauciflorum*, should be planted by themselves or with other very dwarf alpines, so that they will not be smothered by taller and coarser subjects. The tallest, most robust and easiest species is *P. campanuloides*, large clumps of which attain 3 ft. in diam. and grow 2 ft. high. Such a clump makes a fine centerpiece for a flower-bed and blooms through July and Aug. Similar to it but inferior is *P. limonifolium*, with lighter blue fls. Both have oblong inflorescences, as also do *P. Halleri* and *P. spicatum;* the former growing a foot high in dry, sunny spots in a southern border, the latter attaining 1½ ft. on sunny rockwork.

At the other extreme as regards habit, ease of culture and style of inflorescence, is *P. comosum*, which in rockeries requires renewal every few years. A stock should therefore be constantly kept in pots. In the rockery it likes a shady position and in winter the crown should be covered with coarse sand; water freely from the time growth starts until flowering begins. Treated as a pot-plant it is more easily managed; use light soil well mixed with pieces of sandstone about the size of marbles and wedge the roots tightly between very hard stone; plunge the pots in cool material and give partial shade.

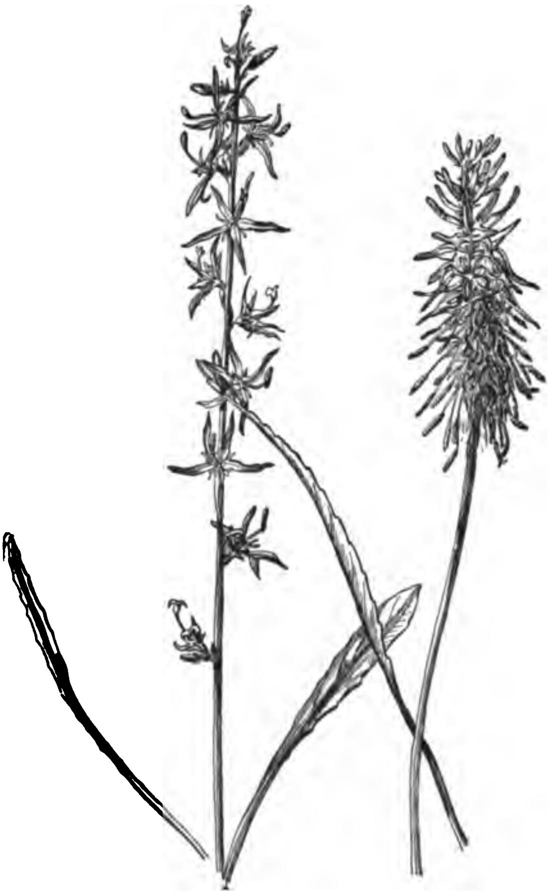
Of the other round-clustered types the following are very much alike: *P. orbiculare, Scheuchzeri, Charmelii* and *Michelii*. *P. hemisphæricum* thrives best in dry, stony places, particularly in the cracks of a crumbling brick wall, or on a steep slope with a southern exposure. It grows 1–6 in. high.

The botanical account following is mainly derived from DC. Prod. 7:450 and Koch, Syn. Flor. Germ. ed. III. 2:402. DeCandolle adopts the 3 sections made by G. Don, of which Section SYNOTOMA contains only the unique *P. comosum*. Section II, HEDRANTHUM, and Section III, PODANTHUM, are distinguished by the pores of the capsule, which are always 3 in the latter and situated near the apex, while in the former they may be 2 or 3 and situated near the middle. To Section III belong species 1, 7 and 8; to Section II belong all the others except *P. comosum*.

INDEX.

Austriacum, 15.
betonicæfolium, 5.
Campanula, 1.
campanuloides, 9.
canescens, 1.
Charmelii, 14, 16.
comosum, 2.
confusum, 15.
globulariæfolium, 11.
Halleri, 7.
hemisphæricum, 12.
humile, 13.
limonifolium, 8.
Michelii, 4.
orbiculare, 15.
pauciflorum, 10.
Scheuchzeri, 17.
scorzonerifolium, 3.
Sieberi, 14.
spicatum, 6.

A. *Inflorescence a raceme or panicle* .... 1. **canescens**
AA. *Inflorescence an umbel* ...... 2. **comosum**
AAA. *Inflorescence a spike.*
B. *Fruiting spikes long and narrow, cylindrical.*
C. *Flowering spikes roundish or oval.*
D. *Stigmas 2.*
E. *Root-lvs. long-stalked* .... 3. **scorzonerifolium**
EE. *Root-lvs. short-stalked* .... 4. **Michelii**
DD. *Stigmas 3* .... 5. **betonicæfolium**
CC. *Flowering spikes oblong or nearly so.*
D. *Spikes dense.*
E. *Color of fls. whitish or yellowish, greenish at tip* .... 6. **spicatum**
EE. *Color of fls. dark violet, rarely white* .... 7. **Halleri**
DD. *Spikes loose* ....
E. *Fls. light blue: stem branched* .... 8. **limonifolium**
EE. *Fls. dark violet: stem not branched.* 9. **campanuloides**
BB. *Fruiting spikes little elongated, merely oval.*
C. *No. of fls. about 5* ....10. **pauciflorum**
CC. *No. of fls. about 12* ......11. **globulariæfolium**
D. *Upper lvs. entire* .....12. **hemisphæricum**
DD. *Upper lvs. remotely denticulate* ....13. **humile**
DDD. *Upper lvs. crenate*....14. **Sieberi**
CCC. *No. of fls. 15 or more.*
D. *Bracts with an ovate base*.................15. **orbiculare**
DD. *Bracts linear.*
E. *Height ½ ft*.........16. **Charmelii**
EE. *Height 1 ft*.........17. **Scheuchzeri**



1792. Two other types of inflorescence in Phyteuma (× ½). The loose-spiked *P. limonifolium* and the denser *P. scorzonerifolium.*

1. **canéscens**, Waldst. & Kit. (*Campánula Americàna*, Hort., not Linn.). Scabrous: stem unbranched: lvs. sessile; lower ones ovate, crenate-serrate, narrowed at base; upper ones nearly entire: fls. blue, short-peduncled, solitary, sparse. Hungary, Caucasus.

2. **comòsum**, Linn. Fig. 1791. The only species in the genus with umbellate inflorescence, and in which the corollas are not finally split at the apex. A decumbent, unbranched, glabrous plant native to the Alps: fls. pale lilac below, darker purple above. B.M. 6478. G.C. II. 14:177. Gn. 18, p. 245, copied in Gn. 28, p. 91; 44, p. 554, and R.H. 1882, p. 452. G.C. II. 26:81, copied in I.H. 34:11.

3. **scorzonerifòlium**, Vill. Fig. 1792. This and *P. betonicæfolium* should probably be regarded as botanical varieties of *P. Michelii*, but for clearness and for

horticultural purposes they may be considered as distinct species. A native of the Alps with fls. of sky-blue (B.M. 2066, erroneously as *P. betonicæfolium*) or purplish blue (B.M. 2271).

4. **Michélii**, All. This may also be distinguished from *P. scorzonerifolium* and *P. betonicæfolium* by having the calyx pilose at the middle, it being glabrous in the other two. A native of Mt. Cenis in Sardinia, with lvs. never cordate. Color of fls. not stated, probably blue.

5. **betonicæfòlium**, Vill. Root-lvs. cordate, long-stalked: bracts fewer than in *P. Michelii* and probably not reflexed. Eu. Not B.M. 2066, which is *P. scorzonerifolium*. Color of fls. not stated.

6. **spicàtum**, Linn. The color of the fls. (whitish or yellowish, green at tips) is highly characteristic: lower lvs. doubly crenate-serrate, long-stalked, cordate: spike oblong, 2–3 in. long. Eu. B.M. 2347.

7. **Hálleri**, All. Lower lvs. doubly and coarsely serrate, long-stalked: spike ovoid-oblong; fls. dark violet to white. Eu.

8. **limoniifòlium**, Sibth. & Sm. Fig. 1792. This may be distinguished from *P. campanuloides* by the stem-lvs., which are fewer and pass into bracts: fls. light blue. The inflorescence is more sparse, but very dainty. Mt. Olympus, Dalmatia, near Naples. B.M. 2145 (*P. stricta*). L.B.C. 7:667 (*P. virgata*).

9. **campanuloìdes**, Bieb. Sufficiently distinguished in the key and under No. 8. Caucasus, Armenia. B.M. 1015 shows a stalk with over 60 fls., while *P. limonifolium* has only 12–30. Fls. dark violet.

10. **pauciflòrum**, Linn. Very dwarf: lvs. entire; root-lvs. short, obovate-lanceolate: bracts ciliate, entire or subdentate at base, never dentate at apex. Western Alps and Pyrenees. Fls. violet, according to Koch.

11. **globulariæfòlium**, Sternb. & Hop. Probably a var. of *P. pauciflorum* with larger stems, root-lvs. 2–4 lines longer and thrice as wide, and the bracts always entire at the base. Austrian Alps. Fls. violet.

12. **hemisphǽricum**, Linn. Lvs. erect; root-lvs. subentire, linear or lanceolate-linear, much or little shorter than the stem: bracts ciliate, subentire: fls. blue, white or yellowish. Alps and Pyrenees.

13. **hùmile**, Schleich. Root-lvs. linear-lanceolate, narrowed at the base, upper ones remotely denticulate: bracts narrowly lanceolate from an ovate base, sharply toothed. Eu. Gn. 28:502. Fls. blue.

14. **Sièberi**, Spreng. (*P. Charmélii*, Sieb., not Vill.). Lvs. cordate, ovate or ovate-lanceolate, crenate: bracts ovate, acuminate, sharply serrate. Eu. Fls. violet, according to Koch.

15. **orbiculàre**, Linn. (*P. confùsum*, Kern. *P. Austrìacum*, G. Beck). Lvs. crenate; root-lvs. cordate or ovate; upper stem-lvs. linear: bracts subserrate. Eu. B.M. 1466 (*P. cordata*); fls. purple. L.B.C. 2:122.—A very variable species with forms ranging from 2–20 in. high.

16. **Charmélii**, Vill., not Sieb. Probably a botanical variety of *P. Scheuchzeri*. Bracts 3–6 lines long, erect or spreading. Alps. Here probably belongs the cut labeled *P. comosum* in Gn. 19, p. 419; 44, p. 554; and *P. orbiculare*, Gn. 28, p. 90.

17. **Scheúchzeri**, All. Bracts 18–24 lines long, reflexed or spreading. This and No. 16 differ from Nos. 10–15 inclusive in having few, narrow, unequal bracts instead of many broad ones which are about equal. S. Eu. B.M. 1797 (fls. purple).

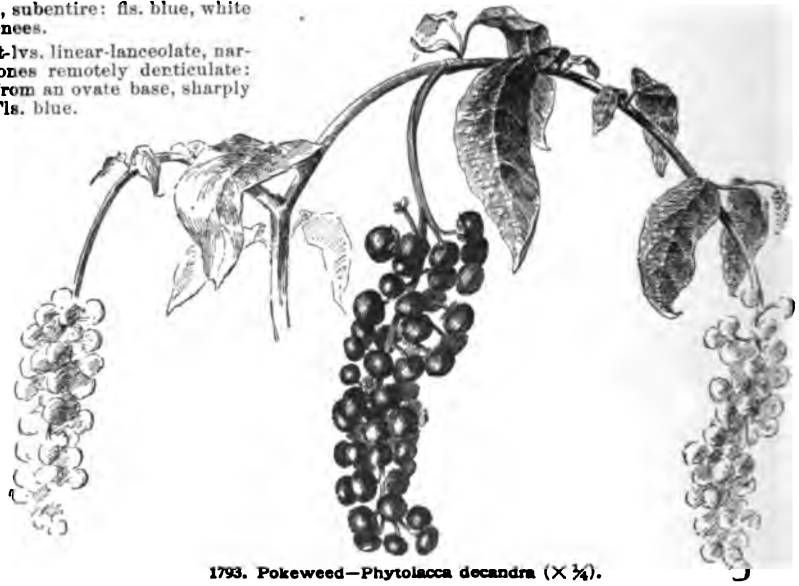
P. Balbísii, DC., is near P. spicatum· stem 4–6 in. high· root-lvs. cordate: spike white, about 9–12 lines long in flower: bracts few, linear, shorter than the fl.: color of fls. not stated Piedmont.—*P. Caréstiæ* of Bir. is P. humile, No. 13, but P. Carestiæ of Vill. is P. serratum, a species probably nowhere in cult., and scarcely to be told from P. humile unless it has a larger stem, little wider lvs. and calyx glabrous instead of minutely ciliate.—*P. laxiflòrum*, R. Beyer and *P. Schellanderi*, are offered by the National Arboretum at Zoeschen.

W. M.

PHYTOLÁCCA (a hybrid name: Greek, *phytos*, plant, and French *lac*, lake; referring to the crimson berries). *Phytolaccàceæ*. *P. decandra*, our common Pokeberry, is sometimes offered by dealers in native plants and its young asparagus-like shoots are sometimes used as a pot herb. Its flattish berries yield a crimson juice of a very distinct hue, but it has never been fixed for dyeing purposes. Children sometimes make red ink from the berries for amusement. Pokeberry is sometimes a troublesome weed. It is thoroughly naturalized in Europe. It has been used to give color to pale wines, but its use for this purpose is injurious and in Portugal is prohibited by royal decree. The roots are emetic, purgative and somewhat narcotic. The word "poke" is supposed to come from the American Indian word *pocan*, which apparently referred to any plant yielding a red or yellow dye, as pokeweed or bloodroot. In President Polk's campaign his followers wore leaves of pokeweed.

In collecting young shoots for greens, care must be taken not to include any portion of the root, as this would give a bitter taste and might cause serious illness. Small pieces of the root eaten by mistake for horse-radish or turnip have caused serious and in some instances fatal cases of poisoning. The seeds are also poisonous.

Phytolacca is a genus of about 10 species of tropical shrubs, herbs or trees, sometimes climbers: lvs. alternate, sessile or petiolate, acute or obtuse, entire: fls. small, greenish white, borne in long racemes which are at first terminal but by further growth of the stem come opposite the lvs.; calyx of 4 or 5 persistent rounded sepals; stamens 5–15: ovary of 5–15 distinct or somewhat united carpels: fr. a fleshy berry; seeds 1 in each cavity



1793. Pokeweed—Phytolacca decandra (× ¼).

decándra, Linn. POKEBERRY. POKEWEED. POKEROOT. Also called Scoke, Garget, Pigeonberry and Inkberry. Fig. 1793. A glabrous, strong-smelling, perennial herb, 4–12 ft. high: root large: lvs. oblong-lanceolate or ovate-lanceolate, acute, petiolate: racemes 2–8 in. long: stamens 10: ovary 10-celled: berries nearly ⅓ in. across, ripe Aug.–Oct. Me. to Minn., south Fla. to Tex. B.M. 931. D. 93. Gn. 21, p. 179. Mn. 1, p. 53.—

Common in clearings. A variegated form once cult. for ornament is shown in R.H. 1887, p. 16, the lvs. light green above often shaded rose and more or less margined white, beneath pale rose to violet.

Lyster H. Dewey and W. M.

PICEA (ancient Latin name derived from *pix*, pitch). *Coniferæ*. Spruce. Ornamental evergreen trees of pyramidal habit with spreading whorled branches clothed densely with acicular spirally arranged lvs. About 18 species in the colder and temperate climates of the northern hemisphere from the arctic circle to the high mountains of the temperate regions. Pyramidal trees, sometimes dwarfed: lvs. usually 4-angled with white lines formed by numerous stomata arranged in rows and on all 4 sides, or compressed and stomatiferous only on the upper side which, on the lateral branchlets, by twisting of the leaf-stalk appears to be the lower one, sessile and jointed at the base to a short stalk projected from a prominent cushion, called a pulvinus: fls. monœcious, catkin-like, terminal or axillary; the staminate yellow or red, consisting of numerous spirally arranged anthers with the connective enlarged at the apex and scale-like; the pistillate greenish or purple, consisting of spirally arranged scales each subtended at the base by a small bract and bearing two ovules at the inner side: cones pendulous or spreading, with persistent scales not separating from the axis after shedding the seeds, which are provided with a large and thin obovate or oblong wing. The names *Picea* and *Abies* are often exactly transposed by horticulturists and others.

The catkin-like fls. of the Spruce appear in spring and are often very conspicuous by their bright red color. These are followed by usually pendent cones, green or purple before ripening and light to dark brown at maturity. The Spruces are not only highly ornamental but also very valuable forest trees, and as inhabitants of cooler climates they are especially adapted for cultivation in northern regions. All are hardy north except *P. Smithiana* and *P. Sitchensis*, but do not resist heat and drought well; some, however, as *P. pungens, orientalis, excelsa*, and also *P. alba* and perhaps *P. Omorika*, endure drought better than most others. For ornamental park planting the Spruces belong to the most valuable evergreens on account of the symmetrical habit and rapid growth of most species. Only a few, like *P. orientalis, obovata, Omorika*, and *polita*, are of slower growth and therefore well suited for smaller parks and gardens; and so are the numerous horticultural forms, which are mostly dwarf and slow-growing and sometimes more interesting and curious than beautiful. The Spruces are often planted as shelters and wind-breaks, and also used for hedges, especially *P. excelsa*, which makes a very dense and durable hedge when regularly trimmed. *P. polita* is also recommended as a good hedge plant and seems well adapted, with its rigid, spiny lvs. The Spruces thrive best in moderately moist, sandy loam, but will grow in almost any kind of soil provided it contains enough moisture; wet and dry soils are equally unfavorable. Slopes of northern aspect are well suited for Spruces, and they thrive better in shady positions than most other conifers. As the roots mostly spread horizontally near the surface, the Spruces will grow in shallow soil and are easily transplanted even as rather large plants; they may be moved with success at any time of the year except when the young shoots are growing, but if possible avoid transplanting shortly before dry weather is expected to set in.

Propagated by seeds, which ripen in fall and are usually kept dry and cool during the winter and sown in spring outdoors in prepared beds or in frames or boxes. The young seedlings should be shaded and watered in dry weather and may remain a year or two before being transplanted in nursery rows when not sown too thickly. Varieties and rarer kinds are often increased by layers or by grafting on seedling stock of *P. excelsa*. *Picea alba* is used for forms of this species and for *P. nigra* and *rubra*. Veneer-grafting in spring or August in the greenhouse is usually employed, less commonly cleft-grafting with half-hardened wood. The dwarf forms grow readily from cuttings under glass in August or fall and given slight bottom heat in early spring; also most other forms and species, especially those with thinner and finer branches, can be raised from cuttings.

The Spruces are important timber trees. The soft and light, straight-grained wood is much used for construction, the interior finish of houses and for fuel, also for ship-building; but it is not durable in the ground. The bark of some species is used for tanning leather, and the resinous exudations are sometimes employed in medicine. From the Red and Black Spruce, Spruce beer is made by boiling the branches with honey. Spruces are often known in nurseries, especially in this country, under the name of Abies.

Alfred Rehder.

1794. Cones of Piceas (× ½).
Largest one, *P. pungens;* lowest one, *P. alba;* upper right hand, *P. nigra*, var. *brevifolia.*

The Piceas embrace some of the most useful as well as ornamental trees of the Conifer family. They cover a great variety of forms, from the stiff-branched, sturdy and rugged *P. pungens* to the lithe, graceful and drooping *P. Breweriana*. The American species comprise *P. alba, nigra, rubra, pungens, Engelmanni, Breweriana* and *Sitchensis*. The grand and towering Douglas Spruce and the graceful Hemlock Spruce, so called, are not true Spruces and will not be noticed in this article.

Picea alba, the White Spruce, is a native of the northern parts of America and is justly thought to be one of our best conifers, a compact and upright grower of great longevity; trees growing at Waukegan, Ill., over fifty years old are still well branched at the bottom, retain their pyramidal form and annually make an upward growth. They are the most aromatic of the Piceas; in fact, this odor is often used to identify them while young from the Norway Spruce or Engelmann's Spruce. They grow on a great variety of soils, bear crowding well and also will stand severe pruning; hence are used for wind-breaks and hedges. They vary considerably in color, some of them fairly rivaling the blue form of the *P. pungens*. This tree, being a native of a cold climate, is subject to the ravages of the red spider in a warm climate and should not be planted south of Philadelphia or St. Louis. There is a variety of *P. alba* found in the Black Hills that stands extreme drought better than the northern form and is largely planted on the dry prairies of Nebraska and the Dakotas. It does not, however, do as well in northern Illinois or farther east as the northern variety.

Picea Engelmanni, one of the gems of Colorado, resembles *P. alba* more than it does its near neighbor *P. pungens*, being of finer foliage and not as stiff-branched as the latter. It is one of the few conifers that will stand the extreme cold of St. Petersburg, Russia, but on our western prairies it soon loses its lower branches, as it seems to be unable to withstand the hot and drying winds of that section in late summer and early autumn. In the eastern states, however, it does not have this fault, as the cooler and more humid air seems to better agree with it.

Another Colorado conifer, *Picea pungens* (the blue form being called by some the "Queen of the Piceas"), is a striking and noble tree, seeming to be hardy wherever tested and on all varieties of soil. Strong, sturdy, and upright in growth, its form alone would make it a striking figure in any landscape. Its beautiful color varies from a light silvery hue in some specimens to a dark blue, almost purple in others. In some specimens the branches are in distinct and regular whorls, resembling *Araucaria excelsa*. Undoubtedly the oldest and finest specimens of this grand tree are found on the former grounds of the late Robert Douglas, at Waukegan, Ill. These trees are now 25 to 30 ft. high and show no signs of weakness anywhere, being one mass of foliage from the ground upward. The green form of *P. pungens* is an excellent tree, but is not as much appreciated by planters and lovers of trees as it should be, as it is always compared to its more striking variety, the Blue Spruce. There is a fine specimen growing on the above grounds, even larger than the blue form, which does not suffer in comparison with its near neighbors, *Abies concolor, A. Fraseri, P. Engelmanni, Tsuga Canadensis* or Hemlock Spruce, *Pseudotsuga Douglasii* or Douglas Spruce, and *Pinus Strobus*, all large and fine specimens, equal to any in the middle west.

Picea nigra, or Black Spruce, is undoubtedly the poorest tree of the genus from a landscape gardener's point of view. It has very short needles and is greatly disfigured by its cones, which hang on for several years. It begins seeding when very young and is an exceedingly slow grower. Some good specimens of it are found, however, in the East, but in very restricted localities. *P. rubra*, long thought to be a variety of the preceding, is a much better tree in every respect, resembling *P. excelsa* in color and form. It seems to be a short-lived tree, especially in the West. This tree is undoubtedly the least known of the American Piceas. *P. Sitchensis* of the Pacific coast strongly resembles *P. pungens*; in fact, when the latter was first introduced it was thought to be a variety of *P. Sitchensis*. It has much finer branches and needles than *P. pungens*, varies in coloring as much as the latter, and where hardy makes a very fine tree. Unfortunately it is not hardy in any of the northern states. Unlike *P. pungens*, it will not stand close planting, as the needles fall off badly where the branches are rubbed together by the wind or strike other objects.

Without doubt the most graceful and elegant Picea is *P. Breweriana*, or Weeping Spruce, a native of the Siskiyou and Coast Ranges of mountains in northern California and Oregon. It has the true Spruce form, tall and symmetrical, with horizontal branches and a beautiful dark green color. In its general features it resembles a well-grown specimen of the Norway Spruce, but its distinguishing beauty is in the long, pliant, pendulous branchlets which hang straight down from the branches to a length of 6 to 8 ft. and no larger around than a lead pencil. It has a stately grace in calm weather, but its characteristic impressiveness is seen only when the long, flexible branches are undulating in a light breeze or streaming before a gale. The bark is smooth and reddish in color, adding to its beauty where glimpses of it can be seen through the green foliage. It grows only at high elevations in its native habitat and on the northern slope of the mountains where the annual fall of snow is 15–25 ft., as the winter trip of the mail-carrier shows. The cones are from 2½ to 3½ in. long, of a purplish color, and as they grow only on the tips of the branches they add greatly to its beauty. Unfortunately this beautiful tree has not proved satisfactory. Out of over 300,000 seedlings raised in 1893, only one plant is now alive; it is growing on the writer's grounds and is scarcely 6 in. tall, having cost over $100 per inch, and this is doubtless the largest specimen in cultivation.

Of the foreign Piceas *P. excelsa* is most popular; in fact is the best known and most largely planted of any of the genus. It makes a large, fine-looking tree, grows in a great variety of soils, is hardy throughout most of North America, is the most rapid grower of any of the Piceas, and stands close planting very well. It is used more than any other tree for wind-breaks and shelter-belts. It bears pruning well. Hedges of this species and *P. alba* that have been planted more than 25 years are growing on the Douglas grounds that are now 6 ft. high and 8 ft. across the base. One fine specimen tree on these grounds measures about 52 ft. high and 55 ft. from tip to tip of its lower branches. Other foreign species, but not as well known nor as thoroughly tested as the preceding, are *P. obovata*, a close, compact-growing tree dark green in color. *P. Smithiana* or *P. Morinda* is one of the handsomest of the Piceas, but is not hardy in the northern states, plants from seed collected at an elevation of 8,000 ft. on the Himalaya mountains not proving hardy. Fine specimens of this tree are found in California, where it is justly prized. There are several species of Picea from China and Japan that will doubtless prove hardy in the eastern states. All Piceas will stand the pruning knife, but this should be used not later than July 1 in the northern states and earlier farther south. They are propagated from seed the same as Larix; and their varieties, of which there are a great number, are either grafted or raised from cuttings over bottom heat.

Thomas H. Douglas.

Note on the Grafting of Piceas.—In the writer's experience, *Picea alba* is a good stock on which to graft the finer varieties of Spruce or those having four-sided leaves. Pot the stock the last of August, keep in shaded frame, syringe till danger of wilting is over and harden gradually. Be careful not to keep the earth in the pots too wet, as roots are liable to rot. Place the stocks in greenhouse after light frosts, and graft as soon as roots have started — about last of January generally. Do not wait until buds have made much growth, for then the sap will be running strongly to the upper buds, leaving the cion to remain dormant. When stock and cion are of same size, the veneer-graft can be used. In large stocks, use slit- or side-graft. Be sure that the knife is sharp enough to shave dry wood. Cut the cion in elongated wedge-shape; place it in the cleft by twisting the stock with left hand, fitting the cion exactly with the right. Be careful to wax well, as a hole the size of a pin left on the cut surface will be fatal to the cion. Place the grafted plants in a close frame until the cion is well started. Syringe from two to three times a day, shading when too hot. Give air gradually until well hardened. Do not cut back the stock for one year, as the cion may make second growth and winter-kill. If cion should die, do not use the stock again until after a year's rest, as two consecutive pottings will usually ruin the plant; this holds good only with Tsuga and *Picea alba*. The above method can be used with equal success on Pinus, Abies, Juniperus and other evergreens propagated by grafting.

E. P. Drew.

1795. Picea excelsa—Norway Spruce.

INDEX.

For names not found here or in the supplementary list, consult Abies and Tsuga.

Abies, 5.
acicularis, 14.
acutissima, 7.
Ajanensis, 13.
alba, 9.
Alcockiana, 13, 14.
alpestris, 5, 15.
argentea, 9, 10, 11.
aurea, 9.
Barryi, 5.
bicolor, 1, 14.
brevifolia, 8.
Breweriana, 16.
Canadensis, 9.
Clanbrasiliana, 5.
cœrulea, 9, 11.
commutata, 10, 11.
compacta, 5.
conica, 5.
denudata, 5.
diffusa, 5.
Doumetti, 8.
dumosa, 5.
elata, 5.
Ellwangeriana, 5.
Engelmanni, 10.
excelsa, 4, 5.
Finedonensis, 5.
glauca, 9, 10, 11.
Gregoryana, 5.
Hondoënsis, 13.
inversa, 5.
Jezoensis, 13.
Khutrow, 2.
Mariana, 8.
Maxwelli, 5.
medioxima, 5.
Menziesi, 11, 12.
miniata, 5.
minuta, 5.
monstrosa, 5.
Morinda, 2.
muricata, 5.
nana, 9.
nigra, 8.
obovata, 3, 4.
Omorika, 15.
orientalis, 6.
Parryana, 11.
parviformis, 5.
pendula, 5, 9.
polita, 1.
procumbens, 5.
pseudopungens, 10.
pumila, 5, 8.
pungens, 11.
pygmæa, 5.
pyramidalis, 5.
rubens, 7.
rubra, 7, 9.
Schrenkiana, 3.
Sitchensis, 12.
Smithiana, 2.
speciosa, 12.
tabulæformis, 5.
Torano, 1.
viminalis, 5.
virgata, 5, 8.
viridis, 11.

A. *Lvs. quadrangular, all 4 sides with stomata.*
  B. *Scales of cone obovate or orbicular, rounded, closely appressed before ripening.*
    C. *Cone 2½–6 in. long.*

D. *Lvs. spreading, very rigid, sharply pointed* .... 1. **polita**
DD. *Lvs. pointing forward, not very rigid.*
E. *Length of lvs. ¾–2 in., or sometimes a little shorter in No. 3: young branchlets glabrous, grayish yellow* .... 2. **Smithiana**
3. **Schrenkiana**
EE. *Length of lvs. ½–1 in., shorter only in dwarf vars.: young branchlets brown* .... 4. **obovata**
5. **excelsa**
EEE. *Length of lvs. 2½–5 lines.* 6. **orientalis**
CC. *Cones ¾–2 in. long.*
D. *Young branches pubescent* .. 7. **rubra**
8. **nigra**
DD. *Young branches glabrous, light brownish yellow* .... 9. **alba**
BB. *Scales of cone oblong or rhomboidal, erose at the margin and usually striate and undulate, thin, very loosely appressed or slightly spreading* ....10. **Engelmanni**
11. **pungens**
AA. *Lvs. more or less flattened, with white lines on the upper side, green on the lower one.*
B. *Cone-scales rhomboidal, erose-denticulate, loose: lvs. much flattened* ....12. **Sitchensis**
13. **Ajanensis**
B. *Cone-scales orbicular or obovate, closely appressed: lvs. quadrangular, somewhat flattened*..14. **bicolor**
C. *Branchlets rather short, not or little pendulous* ....15. **Omorika**
CC. *Branchlets very long and slender, pendulous*..............16. **Breweriana**

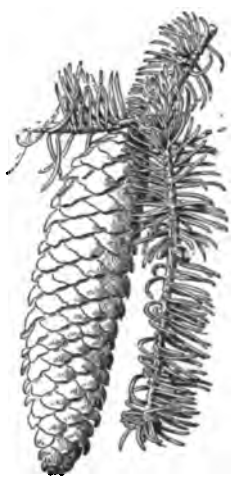
1. **polita**, Carr. (*P. Toràno*, Koehne. *P. bícolor*, Hort., not Maxim.). Tree, to 90 ft., forming a dense, broad pyramid, with rigid stout branches when young, older trees with the habit of *P. excelsa*, with somewhat pendulous branches: young branches thick, glabrous, yellowish brown: lvs. rigid, thicker than broad, often falcate, shining dark green, ½–1 in. long: pistillate fls. green, staminate yellowish: cone oblong, 4–5 in. long, brown, glossy; scales with finely denticulate margin. Japan. S.Z. 2:111. G.C. II. 13:233; III. 21:251. Gn. 13, p. 239.—One of the most distinct Spruces; of very striking appearance with its rigid spiny lvs. spreading in all directions from the stout branches.

2. **Smithiàna**, Boiss. (*P. Morínda*, Link. *P. Khùtrow*, Carr.). Tree, to 150 ft., with wide-spreading branches and slender pendulous branchlets: lvs. crowded, usually thicker than broad, acute, bright or dark green, ¾–2 in. long: pistillate fls. purple: cones 5–7 in. long, dark brown and glossy; scales suborbicular, with entire margin, firm. Himalayas. G.C. II. 24:393. Gn. 19, p. 359; 35, p. 599; 39, p. 72.—One of the most graceful Spruces; tender in New England. The young growth starts very early and is liable to be injured by frost in spring, especially when planted in warm and damp situations.

3. **Schrenkiàna**, Fisch. & Mey. (*P. obovàta*, var. *Schrenkiàna*, Carr.). Tall pyramidal tree, with pendulous branchlets, somewhat similar in habit to *P. excelsa:* lvs. equally 4-sided, acute, somewhat dull green, ¾–1½ in. long, on young plants often slightly shorter: cones cylindric-ovate, 3–4 in. long; scales with entire margin. Cent. Asia.—Said to be very similar in habit to *P. Smithiana*. But recently introduced and only small plants are known in cultivation; quite hardy.

4. **obovàta**, Ledeb. (*P. excélsa*, var. *obovàta*, C. Koch). Tree, to 100 ft., similar in habit to the following, with somewhat pendulous branchlets: young branches brown, glabrous or slightly pubescent: lvs. quadrangular, acute, dull or bluish green, ½–¾ in. long: pistillate fls. purple: cone oblong-ovate, light brown, about 2½ in. long; scales with entire margin. N. Eu. to Kamschatka and Manchuria. Gn. 20, p. 91. R.H. 1894, p. 274. Mn. 5, p. 189.—Of slower growth than *P. excelsa* and more graceful.

5. **excélsa**, Link. (*P. Àbies*, Karst.). NORWAY SPRUCE. Figs. 1795–7. Tree, to 150 ft., with spreading branches and usually pendulous branchlets: bark reddish brown: young branches brown, glabrous or pubescent: lvs. quadrangular, acute, dark green and usually shining, ½–1 in. long: staminate and pistillate fls. bright purple: cones cylindric-oblong, 4–7 in. long, light brown; scales obovate, with erose-denticulate margin. N. and M. Eu. Em. 1:102. Mn. 4, p. 185; 6, p. 85.—This tree is extensively planted as an ornamental tree in the northern and eastern states; it is of rapid growth and is a handsome tree, with its graceful habit and dark green, dense foliage, but, like many Spruces and firs, loses much of its beauty when it grows old, and usually after 30 years it becomes thin and ragged in the top. It is one of the best conifers to plant for shelters and wind-breaks. The Norway Spruce is very variable, and a great number of garden forms are in cultivation. Some of the best known are the following: Var. **Bárryi**, Hort. Dark green, with vigorous, thick branches and short branchlets. Var. **Clanbrasiliàna**, Loud. A dwarf, compact form, with short, crowded branchlets and small, ¼–½-in. long lvs. There are many other dwarf forms, differing somewhat in habit and foliage, as vars. **compácta, cónica, diffùsa, dumòsa, Ellwangeriàna, Gregoryàna, Máxwelli** (Fig. 1798), **muricata, parvifórmis, procúmbens, pùmila, pygmæa, tabulæfórmis**. Var. **Finedonénsis**, Gord. Lvs. pale yellow at first, becoming bronzy brown and finally green. Var. **invérsa**, Carr. With drooping branches closely appressed to the stem. Gng. 6:100. Var. **monstròsa**, Loud. A form with few, thick branches clothed with rigid, thick lvs. Var. **péndula**, Loud. With irregularly disposed pendulous branches and branchlets. Var. **pyramidàlis**, Carr. With the branches ascending at narrow angles, forming a narrow pyramid. Mn. 6, p. 87. Var. **viminàlis**, Willd. Branches in remote whorls, almost horizontal, with very long and slender branchlets without or with very few lateral branchlets. Var. **virgàta**, Jacq. (*denudàta*, Carr.). Sparingly branched, with long and slender branches destitute of branchlets, spreading, usually the lower ones pendulous and the upper ones ascending. R. H. 1854, p. 102. *P. excelsa*, var. *elàta*, Hort., is probably a seedling of this variety and an intermediate form toward the type. Gn. 3:177. There are also some forms with variegated and yellow foliage. Two geographical forms of slow growth and dense habit are var. **alpéstris**, Brügg., from the high Alps, in habit and foliage resembling *P. alba*, and var. **medióxima**, Nyl., from N. Eu., in habit and appearance similar to *P. orientalis*. *P. miniata*, mentioned in the genus Abies in the supplementary list as *A. miniata*, is a misprint for *A. minuta*, which is a synonym of *P. excelsa*, var. *pygmæa*.

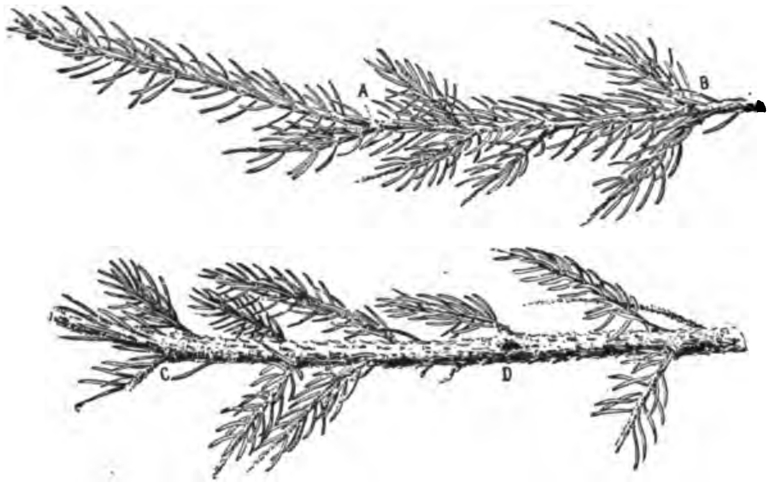


1796. Cone of Norway Spruce. (× ⅓.)

6. **orientàlis**, Carr. Tree, to 120 ft., with ascending and spreading branches and somewhat pendulous branchlets: young branches brown, pubescent: lvs. thick, obtuse, dark green and shining, crowded and more or less appressed to the branches: fls. carmine: cone cylindric-ovate, 2½–3½ in. long, less than 1 in. thick: scales orbicular, entire at the margin. W. Asia, Caucasus. G.C. II. 21:308; 25:333; III. 3:754. A.G. 19:649. Mn. 5, p. 189. V. 20:185.—A very graceful Spruce with dark, glossy foliage; of slow growth and therefore valuable for smaller gardens. It holds its lower limbs for many years.

7. **rùbra,** Link (*P. acutíssima,* J. G. Jack. *P. rùbens,* Sarg.). Red Spruce. Tree, to 80 ft. or occasionally to 100 ft., with short and slender branches forming a narrow pyramidal head, with red-brown bark: young branches reddish brown: lvs. quadrangular, acute or mucronate, dark or bright green, shining, about ½ in. long: fls. purple: cones oblong, 1¼–2 in. long, light reddish brown, glossy; scales obovate, rounded and entire or slightly erose at the margin. From Canada to N. C., along the Alleghany Mts. S.S. 12:597.—Handsome tree, but requires cool and moist situation and is less drought-enduring than most others.

8. **nigra,** Link (*P. Mariàna,* Britt., Sterns & Pogg.). Fig. 1799. Tree, usually to 20–30 ft. or occasionally to 100 ft., with slender, often pendulous branches forming a narrow, irregular head: bark gray-brown: young branches brown or yellowish brown: lvs. quadrangular, obtusish, dull dark or bluish green, bloomy especially on the upper side, ¼–¾ in. long: fls. purple: cones oval-oblong, globose-ovate when open, dull grayish brown, ½–1½ in. long; scales rounded and finely denticulate at the margin. From Can. to Va., Minn. and Brit. Col. S.S. 12:596.—Very variable in habit; cone-bearing trees often only a few ft. high when growing in swamps. The most ornamental garden form is var. **Doumétti,** Carr., with ascending crowded branches forming a dense conical pyramid. A similar form, somewhat broader at the base and with more light bluish green foliage, is var. **Mariàna,** Beissn. G.C. III. 11:80. Var. **brevifòlia,** Rehd. (*P. brevifòlia,* Peck). Fig. 1794. Small tree, with short spreading branches forming an irregular and narrow head: lvs. usually ¼–⅛ in. long, bluish green: cones ½–1 in., seeds 1-12 in. long. Of little ornamental value. V. 23:291. A.G. 23:201, 203. Var. **virgàta,** Rehd., is a sparingly branched form with long and slender branches destitute of branchlets, very similar to *P. excelsa,* var. *virgata.* G.F. 8:45. Var. **pùmila,** Hort., is a dwarf, compact, cushion-like form of very dark green color.



1797. Shedding of the leaves of Norway Spruce.

The picture shows the extremities of a limb that is eight years old. The part between the tip and A is last season's growth; between A and B it is two years old; and beyond B is a part that grew three seasons ago. The section beyond C is six years old; from C to D is seven years of age. The four years' growth of this limb not shown in the drawing was as densely covered with foliage as is the part shown in the upper figure; but there are not many leaves between C and D (seven years old) and none on the eight-year-old wood (except those on the branchlets, and these are younger). This shows that the leaves persisted six or seven years.

9. **álba,** Link (*P. Canadénsis,* Britt., Sterns & Pogg.). Fig. 1794. Tree, usually 60–70, sometimes to 150 ft., with ascendent branches and usually pendent branchlets: bark light brownish gray: lvs. slightly curved, acute or acutish, more or less bluish green, ⅓–¾ in. long, of a strong, aromatic odor when bruised: fls. pale red or yellowish: cones cylindric-oblong, light brown and glossy, 1½–2 in. long; scales orbicular, with usually entire margin, thin and flexible. From Labrador to Alaska, south to Mont., Minn. and N. Y. S.S. 12:598. G.F. 8:223; 9:355. F.S. 21:2251.—A decorative species of dense habit when young and with rather light bluish green foliage; it endures heat and drought much better than the two preceding species. The most important garden form is var. **cærùlea,** Carr. (var. *argéntea* and var. *glaùca,* Hort. *Àbies rùbra,* var. *violàcea,* Loud.). Of dense habit, with light bluish green or almost silvery gray foliage. Var. **aùrea,** Beissn., has yellow foliage. Var. **nàna,** Loud. Dwarf, forming a dense round bush. Var. **péndula,** Beissn. With pendulous branches.

10. **Éngelmanni,** Engelm. (*Àbies commutàta,* Murr.). Tree, to 150 ft., with slender spreading branches in closely arranged whorls, forming a dense and narrow pyramid in young trees: winter-buds with brownish yellow usually appressed or little spreading scales: young branches pale brownish yellow, pubescent: lvs. slender, straight or slightly incurved, acute, bluish green to steel-blue, ½–1 in. long, without resin canals, of a strong aromatic odor when bruised: fls. purple: cones oval- to cylindric-oblong, light brown, 1½–3 in. long; scales rhomboidal, narrowed and truncate or rarely acute at the apex. From Alberta and Brit. Col. to Ariz. and N. M. S.S. 12:599.—A very ornamental tree, varying in the color of foliage. Var. **glaùca,** Hort., has bluish or steel-blue, and var. **argéntea,** Hort., silvery gray foliage. *P. pseudopungens,* Dieck, seems not to differ from typical P. Engelmanni. *P. Engelmanni* is said to be sold for *P. pungens.* It is more common, and its seeds are therefore more readily secured.

11. **púngens,** Engelm. (*P. Parryàna,* Sarg. *Àbies Ménziesi,* Engelm., not Lindl.). Fig. 1794, 1798. Tree, 80–100, or occasionally to 150 ft., with horizontal stout branches in rather remote whorls, forming a broad, regular pyramid: winter-buds with brownish yellow usually reflexed scales: young branches glabrous, bright yellowish brown: lvs. rigid, incurved, spiny-acuminate, bluish green to silvery white or rarely dull green, ¾ to one and one-fifth in. long, with 2 resin canals: cones cylindric-oblong, light brown and glossy, 2½–4 in. long; scales rhomboidal, narrowed and erose at the apex. Wyo. to Colo. and Utah. S.S. 12:600. G.C. II. 20:725; III. 10:547. Mn. 7, p. 51. Gng. 7:49. S.H. 2:273. F. 1884, p. 5. G.M. 40:35.—A very handsome and very hardy tree of symmetrical habit, with light, sometimes almost silvery white foliage. According to the different shades of color of the foliage, vars. **argéntea, cærùlea** and **glaùca,** Hort., are distinguished. Var. **viridis,** Regel (*P. commutàta,* Hort.), is the form with green lvs. A dwarf compact form of this species originated about 10 years ago at the Arnold Arboretrum.

12. **Sitchénsis,** Carr. (*Àbies Ménziesi,* Lindl.). Tideland Spruce. Sitka Spruce. Tree, usually 100 ft., occasionally 200 ft. high, with slender horizontal branches, forming a broad pyramid in young trees; in old trees the upper branches short and ascending, the lower ones slender and spreading, clothed with slender branchlets: bark bright or dark red-brown: young branches rigid, light brownish yellow, glabrous: lvs. bright green, shining and rounded on the lower side, flat, slightly ridged and silvery white on the upper side, sharply acute or acuminate, ½–1 in. long: staminate fls. red: cones cylindric-oval, pale yellowish or reddish brown, 2½–4 in. long; scales rounded at the apex and erose. Alaska to Calif. G.C. II. 25:728, 729. S.S. 12:602. G.F.

4:211 (erroneously named Douglas Fir). M.D.G. 1896:403. —A very ornamental tree, especially attractive by the contrasting colors of the foliage, but it can hardly be grown successfully in the eastern states; it does not stand the hot summers well, and is probably not hardy farther north than Mass. Var. **speciòsa**, Beissn., is of slower growth and more compact habit, with more ascending branches and shorter, more rigid lvs.

13. **Ajanénsis**, Fisch. (*Abies Jezoénsis*, Sieb. & Zucc. *P. Hondoénsis*, Mayr. *P. Alcockiàna*, Veitch partly). Tree, 100–150 ft. or occasionally higher, with horizontally spreading slender branches: bark dark gray: young branches glabrous, shining, yellowish brown or yellowish green: lvs. slightly curved, acute or obtuse, slightly ridged on both sides, dark green and shining below, silvery white above, ½–¾ in. long: fls. carmine: cones oblong, light brown, 1½–3½ in. long; scales oval-oblong, erose. E. Siber., Amurland, Sachatin, Yeso. B. M. 6743. G.C. II. 13: 115, 212; III. 3, p. 53. Gt. 38, p. 217, figs. 2–5.—Similar to the preceding and highly ornamental, hardier: lvs. somewhat broader and shorter and less sharply pointed than in the preceding. *P. Ajanensis* and *P. Hondoensis* are considered by Mayr as two distinct species: the first has yellowish green branches and on older plants the slightly swollen leaf-cushions are recurved; the latter has light reddish brown branches, the leaf-cushions on the upper side of the branches are much swollen, pointing forward, with two small furrows below the apex, the lvs. somewhat shorter and the bracts of the scales somewhat narrowed near the middle.

14. **bicolor**, Mayr (*P. Alcockiàna*, Carr., partly. *Abies bicolor*, Maxim.). Tree, 80–150 ft., with slender spreading branches: bark grayish brown: young branches dull reddish brown, sometimes finely pubescent: lvs. somewhat curved, dark green above with two bluish lines below, sharply acuminate, ½–¾ in. long: cones oblong, brown, purple before ripening, 3–4 in. long; scales obovate, finely denticulate at the often recurved margin. Japan. G.C. II. 13, p. 213.—Handsome tree, with more slender branches than the preceding and of more rapid growth. Sometimes cult. under the name *P. Alcockiana nova* and *P. acicularis*.

15. **Omorika**, Bolle (*Pinus Omorika*, Pancic.). Tree, to 100 ft. or higher, with rather short spreading and ascending branches forming a narrow pyramidal head: young branches brown, pubescent: lvs. compressed, ridged on both sides, obtuse and mucronulate, dark green and shining below, with whitish lines above, ½–½ in. long: fls. purple: cones ovate-oblong, cinnamon-brown, glossy, 1½–2½ in. long; scales almost orbicular, with finely denticulate margin. S. E. Eu. G.C. II. 21:308; III. 21:153. Gt. 47, p. 177.—Handsome tree of rather slow growth, forming a dense and narrow pyramid when young; very hardy.

1798. Picea pungens.

The two small tufts at the right are *P. excelsa*, var. *Maxwelli*.

16. **Breweriàna**, Wats. Tree, 80–120 ft. high, with the branches at the top slightly ascending, the lower ones horizontal or pendulous, with whip-like pendulous branchlets often 7 or 8 ft. long, furnished with similar, slender lateral branchlets; young branches reddish brown, pubescent: lvs. straight or slightly curved, obtuse, rounded and dark green at the lower surface, almost flat and with white lines above, ¾–1 in. long: staminate fls. purple: cones oblong, 2½–5 in. long, light orange-brown; scales obovate, with entire margin. Siskiyou Mts. in Ore. and N. Calif. S.S. 12:601. G.F. 3:66, 67; 5:595. G.C. II. 25:497.—One of the most distinct Spruces, but it has not yet been successfully cultivated in the eastern states.

1799. Picea nigra (× ½).

P. Columbiàna, Lemm., is a form of P. Engelmanni, of smaller size, with smaller cones and scaly brown bark.—*P. Gléhni*, Mast. Tree, to 150 ft., allied to P. bicolor, but lvs. shorter, about ¼–½ in. long and comparatively broad: cones 1–2 in. long. Amurland, Sachalin, Yeso. G.C. II. 13:301.—*P. Maximowiczi*, Regel. Allied to P. polita, but much smaller in every part: lvs. about ½, cones 2 in. long, smaller in cult. plants. Japan.

ALFRED REHDER.

PICKEREL-WEED. *Pontederia.*

PICOTEE. See *Carnation.*

PICRÁSMA (Greek, *pikrasmos*, bitterness; referring to the bitter bark and wood). Including *Picràna*. *Simarubàceæ*. Trees and shrubs, with alternate, odd-pinnate lvs., yellowish green fls. in axillary, long-peduncled, loose cymes and subglobose, dry, berry-like fr. About 8 species in S. and E. Asia and W. India. Only P. **ailanthoides**, Planch. (*P. Japònica*, Gray), seems to be in cult. It is an upright shrub, almost glabrous except the tomentulose inflorescence: lvs. with 4–8 pairs of lfts.; lfts. ovate or oblong-ovate, acuminate, crenately serrate, 2½–3½ in. long: fr. pea-sized, bright red, with 1 seed. N. China, Japan. This is probably the hardiest species of the genus, but has proved only half-hardy at the Arnold Arboretum. Farther north it may be of value on account of its orange and scarlet fall coloring and the bright red fruits. It is sometimes united with *P. quassioides*, Benn., from Himalaya and China. Wood and bark are exceedingly bitter. The wood of some species, especially *P. excelsa*, Planch., from Jamaica, is used in medicine like that of Quassia.

ALFRED REHDER.

PICTURES. See *Photography.*

PIE-PLANT. See *Rhubarb.*

PIÈRIS (a mythological name). Including *Portùna*. *Ericàceæ*. Ornamental evergreen or deciduous shrubs or rarely small trees, with alternate short-petioled lvs. and handsome usually white fls. in often-panicled racemes or in racemose axillary fascicles. The evergreen *P. floribunda* and the deciduous *P. Mariana* are hardy North and, like the other species, are valuable for the earliness of their flowers. The most beautiful are *P. Japonica* and *P. formosa*, with long drooping or nodding racemes of white fls. arranged in terminal panicles; the first thrives still in Mass., but the fls. are usually winter-killed, while *P. formosa* can be grown only South. They are easily forced, and *P. Japonica* especially may be recommended for this purpose; it makes a very handsome and graceful pot-plant for inside decoration with its slender racemes of pure white flowers hanging over the glossy bright green foliage. The species of Pieris, like other Ericaceæ, grow well in a moderately moist, well-drained and porous soil, but dislike limestone and heavy clay; a partly shaded situation suits them best. Prop. by seeds treated like those of Azalea or Rhododendron; also by layers, and the evergreen ones by cuttings of almost ripened wood in August under glass, kept during the winter in a cool greenhouse. They root very slowly; cuttings taken from forced plants root more readily. About 10 species in N. Amer. and in Asia from Himal. to Japan. Calyx-lobes valvate or distinct; corolla globose or urceolate; stamens 10; anthers obtuse, with a pair of awns near the base or the filaments 2-toothed below the apex: capsule with 5 dehiscent valves; seeds linear-oblong, not winged, with membranaceous testa. Often included under Andromeda. Closely allied to Lyonia, but distinguished by its awnless anthers, and to Zenobia, which has the anthers 4-awned at the apex. The foliage of some species is said to be poisonous to cattle.

A. *Lvs. evergreen.*

B. *Flowers in terminal panicles formed the previous year and remaining naked during the winter: capsule globose, without ridges.*

floribúnda, Benth. & Hook. (*Andrómeda floribúnda*, Pursh. *Portùna floribúnda*, Nutt.). Fig. 1800. Dense shrub, 2–6 ft. high: branches and petioles with strigose brown hairs: lvs. ovate to oblong-lanceolate, acute, minutely serrulate and setosely ciliate, otherwise glabrous, 1½–2½ in. long: fls. nodding, in terminal dense upright panicles 1½–4 in. long; corolla ovate, strongly 5 angled, white, ¼ in. long. April, May. Va. to Ga., in the Alleghany Mts. B.M. 1566. B.R. 10:807. M.D.G. 1898:333.—Very desirable evergreen shrub for its hardiness and earliness of the fls.

Japónica, D. Don (*Andrómeda Japónica*, Thunb.). Fig. 1801. Shrub, with spreading branches or sometimes small tree to 30 ft.: branches glabrous: lvs. crowded at the ends of branches, obovate-lanceolate or oblanceolate, crenately serrulate, cuneate at the base, glabrous, 1½–2½ in. long: fls. in pendulous panicles, 2½–5 in. long; corolla ovate, not angled, ¼ in. or slightly longer. April, May. Japan. R.B. 11:10. B.H. 21:19. Gn. 12:98 and p. 424; 50, p. 307; 57, p. 399. G.C. II. 17:797. M.D.G. 1898:544.—Var. **albo-marginàta**, Hort. Lvs. with whitish margin and smaller. Var. **pygmæa**, Maxim. Dwarf form with small linear-oblanceolate lvs. Japanese botanists speak of a variety with the racemes a foot and more long; this form seems to be not yet introduced. *P. Japonica* is one of the most graceful early-blooming evergreens.

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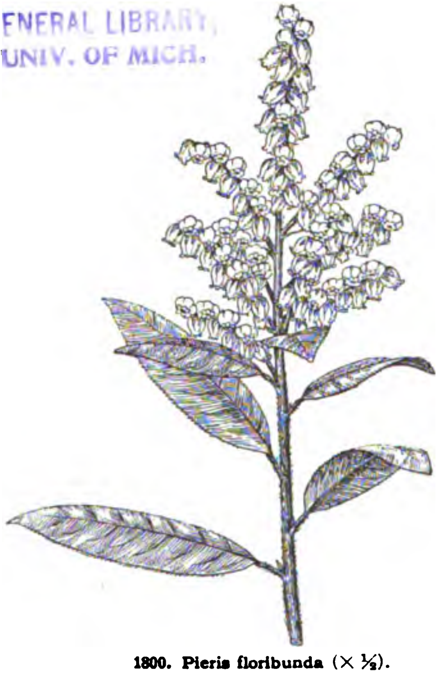
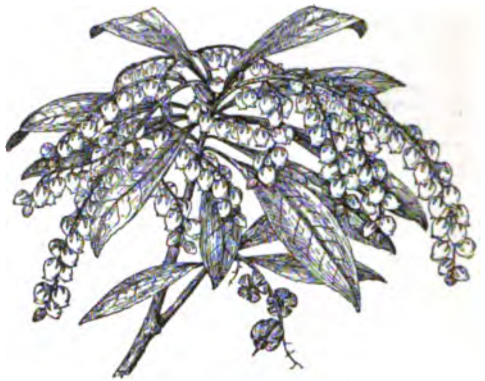


1800. Pieris floribunda (× ½).



1801. Pieris Japonica (× ½).

BB. *Fls. in axillary clusters, forming terminal leafy racemes.*

nítida, Benth. & Hook. (*Andrómeda nítida*, Bartr. *A. coriàcea*, Ait.). FETTER-BUSH. Shrub, 2–6 ft. high, with triangular branches, quite glabrous: lvs. obovate or broadly elliptic to oblong, narrowed at both ends, bright green and shining above, entire and slightly revolute at the margin, 1½–3 in. long: corolla cylindric-ovate, white to pink, ¼–⅓ in. long: capsule ovoid globose, with ridges at the sutures. March–May. N. C. to Fla. and La. B.M. 1095.—Var. **rùbra**, Lodd. Fls. deep pink. L.B.C. 7:672.

AA. *Lvs. deciduous.*

Mariàna, Benth. & Hook. (*Andrómeda Mariàna*, Linn. *Lyònia Mariàna*, D. Don. *Leucòthoë Mariàna*, DC.). STAGGER-BUSH. Shrub, 2–4 ft. high, glabrous or nearly so: lvs. oval to oblong, obtuse or acute, usually cuneate at the base, entire, 1–3 in. long: fls. nodding, in axillary clusters on leafless branches of the previous year, forming 2–5 in. long racemes; corolla cylindric-campanulate, white or pale pink, almost ½ in. long: capsule ovate-pyramidal. April–June. R. I. to Fla. B.M. 1579.

P. formòsa, D. Don. Evergreen shrub or small tree, to 12 ft., allied to P. Japonica: lvs. scattered, broader, elliptic, 3–5 in. long: panicles 6 in. or more long. April, May. Himalayas. Gn. 54, p. 77. G.C. II. 15:569.—*P. ovalifòlia*, D. Don. Deciduous shrub or tree, to 40 ft.: lvs. ovate to elliptic, entire, pubescent on the veins beneath, 2–6 in. long: fls. ovate, white, in simple lateral racemes, 2–6 in. long. June. Himalayas to Japan. About as hardy as P. Japonica.—*P. phillyeæfòlia*, DC. Evergreen shrub, 1–2 ft., glabrous: lvs. oblong, serrulate near the apex, 1–2 in. long: racemes axillary, 4–12-fld.: corolla ovoid, white. Feb., March. W. Fla. B.R. 30:36.

ALFRED REHDER.

PIGEON BERRY. *Phytolacca decandra.*

PIGEON PEA. *Cajanus Indicus.*

PIGEON PLUM. See *Coccoloba.*

PIG-NUT. See *Hicoria.*

PIGWEED. Species of *Chenopodium* and *Amarantus.*

PÌLEA (pileus, a Roman cap; one of the segments of the perianth in the first described species covering the akene). *Urticàceæ.* Many tropical and some temperate-region herbs (rarely shrubby), annual or perennial, of various habit. Most of them are weedy plants, but forms of one or two species are grown in greenhouses for their compact fern-like sprays and for the interesting phenomenon of forcibly discharging the pollen, whence the name Artillery Plant. The species are widely distributed in the Old and New World. The flowers are monœcious or diœcious, mostly very small and in axillary clusters; stamens 3-4, and the sepal-lobes in the staminate fls. of the same number; sepal-lobes of pistillate fls. 3, the ovary 3-angled and erect and bearing a sessile tufted stigma, with 3 scale-like staminodiums: fr. an akene, ovate or nearly orbicular, compressed, more or less invested in the perianth. There are 150 or more species of Pilea, one of which, *P. pumila*, is a small nettle-like plant growing in the northern states.

The Artillery Plants of the gardens are small branchy half-succulent herbs, usually grown in pots and allowed to reach a foot or so in height. The gracefully curving fronds of small ovate or obovate shining leaves are much prized. They are easy to grow, being propagated by cuttings. They thrive best when given an abundance of water. Sometimes they are used as edgings in orchid houses, to screen the pots with green, and they also tend to equalize the moisture conditions and thereby contribute to the welfare of the orchids.

When the staminate flowers open, the pollen is usually discharged forcibly and visibly. If a plant is put in a sunny place when the pollen is ripe, it may set up a vigorous bombardment, particularly if the foliage is sprayed. (See I. H. 1, p. 64 (1854) for an account of this phenomenon.) The Artillery Plant is seen in nearly every greenhouse, but whether there is more than one species in common cultivation it is difficult to determine, for specific characters are difficult to draw. The lvs., although opposite, are unequal. Usually the branchlets develop alternately on the branch.

microphýlla, Liebm. (*P. muscòsa*, Lindl. *P. callitrichioìdes* of some authors). Monœcious: small, rather weak plant: lvs. less than ¼ in. long as a rule, sometimes very small: fl.-clusters mostly sessile or nearly so. S. Amer.

serpyllifòlia, Wedd. (*P. muscòsa*, Hort. in part. *P. callitrichioìdes* of some). Fig. 1802. Diœcious: plant usually stronger and more upright: lvs. usually more than ¼ in. long, and fl.-clusters more peduncled. Mex. Seems to be the commoner species, but it is difficult to determine them. L. H. B

1802. Artillery Plant—Pilea serpyllifolia. Separate spray natural size.

PILOCÁRPUS (Greek, *pilos*, a cap, and *karpos*, a fruit, from the shape of the fruit). *Rutàceæ*. Shrubs or small trees, sometimes attaining 10 ft., with pinnately compound lvs. of 1–4 pairs and a terminal leaflet; the lfts. opposite, but the lvs. usually alternate: fls. in elongated racemes; petals 4–5, valvate; stamens 4–5: ovary 4–5-lobed, not tubercled. The plants of the genus form the source of the alkaloid "pilocarpine," and together with plants of several other genera, the basis of the drug "Jaborandi." Seventeen species, natives of tropical America, principally Brazil.

pennatifòlius, Lem. Branchlets glabrous or puberulent: lvs. alternate, 1–1½ ft. long; lfts. 2 or 3 pairs, besides the terminal one, 3–9 in. long, oblong; apex rounded or emarginate, coriaceous, yellowish green: raceme spike-like, many-fld. (about 100); rachis stout, pedicels stout, horizontal, with 2 small greenish tooth-shaped bracts at their bases: fls. reddish brown, rotate. Brazil. B.M. 7235.—Int. into Calif. by Dr. Franceschi, and said to be hardy in the open wherever the lemon can be successfully grown.

P. Jaborándi, Holmes, has been described as P. pennatifolius, by Benth. & Trim., but is distinguished from it by shorter lvs. and lfts., stiffly pubescent branchlets and stems, more openly fld. racemes, with slender rachis and pedicels, and the presence of 2 inconspicuous bracteoles above the middle of the flower pedicels. B.M. 7483. ARNOLD V. STUBENRAUCH.

PILOCÈREUS (Latin, *pilus*, hair). *Cactàceæ*. A somewhat hetereogeneous assemblage of forms differing from related species principally by the presence in the fruiting area of different or more copious and lengthened hairs or bristles, in some of the species aggregated in a circumscribed area and termed a cephalium. For culture, see *Cactus*.

INDEX.

Brunnowii, 5.
Celsianus, 5.
chrysomallus, 9.
Columna-Trajani, 8.
Dautwitzii, 11.
exerens, 12.
floccusus, 6.
fossulatus, 5.
Haagei, 11.
Hoppenstedtii, 4.
Houlletii, 7.
polylophus, 3.
Royeni, 6.
Sargentianus, 1.
Schottii, 1.
scoparius, 2.
senilis, 10.
virens, 12.

A. *Fruiting area circumferential, of lengthened bristles or weak spines, without woolly hairs: no hairs on areolæ of young shoots.*

1. **Schóttii**, Lem. (*P. Sargentiànus*, Orc.). Fig. 1803. Branching from the base, 10–15 ft. high, glaucous: ribs 4–10, commonly 5; spines 4–7, very short, thickened at base: areolæ of the fruiting area bearing very copious and long (1–3 in.) stiffish twisted bristles: fls. small, pinkish, about 1 in. long: fr. soft, edible, the size and somewhat the color of an olive. North Mexico and Baja, California. G.F. 4:437.

2. **scopàrius**, Poselg. Tree-like, richly branched, 25 ft. high, 1 ft. in diam.: radial spines 12–15, very short, centrals 7–8, not much longer; in the flowering branches the spines change to longer stout bristles and the areolæ are closer together, forming a bristly cephalium: fls. small, bell-shaped, reddish: fr. size of a hazelnut. Near Vera Cruz, Mex.

3. **polylòphus**, Salm-Dyck (*Cèreus Nickelsii*, Hort.). Columnar, attaining a height of 50 ft. and a diam. of 1½ ft., rarely branching: ribs 10–22, sharp-angled, shallow, the old stems perfectly cylindrical: spines small and bristle-like, less than ⅛ in. long; radials 5–6; central usually 1; spines of the flowering area 2–3 in. long, crowded: fls. large, trumpet-shaped, dark red: fr. red, scaly. Mex.

AA. *Fruiting area lateral, of dense tufts of wool in which the flowers are imbedded: young shoots lanuginous, except in P. Hoppenstedtii.*

4. **Hoppenstédtii**, Web. Columnar, simple, slender, reaching a height of 30 ft.: ribs numerous, more than 16: radial spines 14–18, very short; centrals 5–8, the lower longest one reaching 3 in.; all the spines at first yellowish, then white: cephalium of 1–2 in. long tufts of yellowish hairs, forming a narrow bract on the north side of the plant: fls. 3 in. long, bell-shaped, whitish, with rosy tips. Mex.

5. **Celsiànus**, Lem. (*P. fossulàtus*, Lab.). Columnar, in the gardens simple, hardly more than 4 ft. high, 3 in. in diam.: ribs 10–17, bright green; areolæ bearing long (2 in.) white hair; radial spines usually 9, the lower one, the longest, less than 1 in. long; central usually 1, sometimes 4, the longest sometimes 3 in. long, all yellow: fls. not known. Andes of Bolivia.

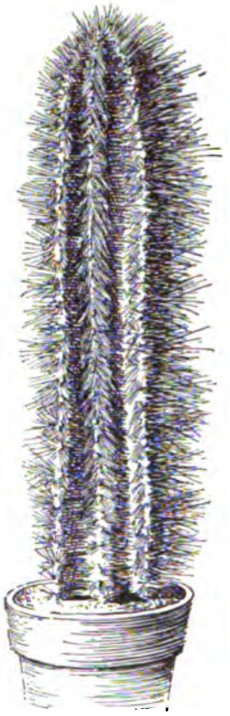
Var. **Brúnnowii**, Schum. (*P. Brúnnowii*, Haage Jun.). Stem stouter: wool brownish, more copious; spines stronger and darker.

6. **Royéni**, Rümpl. (*P. floccòsus*, Lem.). Columnar, branching, reaching 15 ft. in height, 2–3 in. in diam.: ribs 9–10, obtuse bluish pruinose: spines 12–16, rigid, divaricate, bright amber-yellow, the inner ones larger, nearly an inch long: on the sterile branches long hairs are found on areolæ, on the fertile bract these are more numerous and aggregated: fls. and fr. as in the last species, but lighter in color. Island of St. Croix.

7. **Houllètii,** Lem. Tree-like, attaining 40 ft. in height: branches divaricate; cultivated plants usually 3–4 in. in diam: ribs 6–8, rounded, glaucous; radial spines 7–9, spreading ½ in. long, honey yellow, central twice as long and stronger: areolæ of the sterile stem with more or less hairs, which in the fruiting area are very numerous, making a shaggy tract sometimes 1 ft. long: fls. 3 in. long, imbedded in the wool, turbinate, greenish red outside, rose-red within: fr. dark red, depressed-globose. Mexico. R.H. 1862, pp. 427–430.

AAA. *Fruiting area a prominent cephalium composed of dense locks of woolly hairs intermixed with bristles, unilateral except sometimes in P. chrysomallus.*

B. *Long hairs absent except in the cephalium.*



1803. Pilocereus Schottii.

8. **Colúmna-Trajàni,** Salm-Dyck. Tree-like, attaining a height of 50 ft. and a diam. of over 2 ft., simple below: areolæ large, elliptic; radial spines 10–12, the upper very short, the lower longest, nearly an inch long; centrals 2, the upper an inch long, the lower 4–5 in.: fls. about 2 in. long, scarcely projecting from the unilateral woolly and bristly cephalium. Mex. R.H. 1890, p. 129. The specific name refers to the famous Trajan's Column.

BB. *Long hairs covering all but the oldest parts of the plant.*

9. **chrysomállus,** Lem. Tree-like, with erect branches, reaching a height of 30 ft.: ribs in cultivated plants 13: areolæ with long hairs; radial spines 11–13, the upper ½ in. long, the lower twice as long; centrals 4, still longer; all the spines amber-yellow, becoming brown: cephalium terminal or sometimes unilateral, a foot long, woolly and setose. Mex.

10. **senilis,** Pfeiff. OLD MAN CACTUS. Columnar, reaching a height of 35 ft. and a diam. of 1 ft., branching at the very base, the branches becoming parallel with the parent: ribs 20–30, very little elevated; areolæ bearing 20 to 30 white, wavy bristles 2–5 in. long; later appear also, at first 1, then 3–5 strong, yellowish spines: fls. very numerous in the cephalium, nearly 4 in. long, red outside, reddish white within: fr. violet, 2 in. long. Central Mex. R.H. 1889, p. 568; 1890, p. 128.

11. **Daútwiztii,** Haage (*P. Hadgei*, Poselg.). Columnar, reaching 5 ft. in height, 4 in. in diam.: ribs 25–30, low, obtuse: areolæ close together, bearing over 20 needle-like, spreading and interlocking spines, and also copious long, white, curled hairs which cover the whole upper part of the plant, like a spider's web: cephalium and fl. not certainly known. Northern Peru. G.C. 1873:7. F.S. 21:2163.

AAAA. *Fruiting areolæ and younger parts of the plant bearing short hairs, but cephalium wanting.*

12. **exèrens,** Schum. (*P. virens*, Lem.). Branching at base, 3–4 ft. high, 2–3 in. in diam., tapering above: ribs 4–6, obtuse, the sterile shoots with short, sparse, woolly hairs at the top; spines commonly 7 radials, very short, 1–3 centrals 4 times as long; woolly hairs much more abundant on the blooming plant: fls. about 3 in. long, trumpet-bell-shaped, without wool or spines. Brazil.

KATHARINE BRANDEGEE.

PILÓGYNE. See *Melothria*.

PILÚMNA. See *Trichopilia*.

PIMÈLEA (Greek, *fat;* referring to the fleshy seeds). *Thymelæàceæ.* RICE FLOWER. A genus comprising many showy species, and confined almost exclusively to Australia and neighboring islands. They are mostly delicate shrubs, fitted only for greenhouse culture, though reported to be hardy in the open wherever the lemon can be successfully grown. Lvs. nearly always opposite, always simple and entire: inflorescence usually a terminal head or cluster, never umbellate, often with an involucre of 4 or more bracts at the base: perianth tubular, with a spreading (rarely erect) 4-lobed limb: stamens 2, inserted in the throat opposite the 2 outer perianth-lobes: ovary 1-celled: fr. a small drupe. Of the many species, only three (*P. decussata*, *P. ligustrina* and *P. spectabilis*) have been actually introduced into the U. S., but there are so many other very showy species, some of which are already in the Old World, that in all probability more will soon be found in our collections for greenhouse culture. For the latter the soil should be a mixture of peat and loam, with enough sharp sand added to make it "gritty," and special care given to insure perfect drainage. After blooming, the plants should be cut back severely to stimulate new growth. They can be propagated from either seeds or cuttings. Ernest Braunton writes: "*P. decussata* is an elegant little shrub, of uncertain existence. In southern Calif. it attains a height of 3 ft., with the same width at the top, flowers magnificently and then dies. In northern Calif. it does the same. In the open ground it lives 3–5 years, and must have shade."

ARNOLD V. STUBENRAUCH.

Cuttings of well-ripened wood of *P. spectabilis* and *P. decussata* root freely at 60° placed under a bell-glass, in a shaded house. They are not strong growers and must not be over-potted. During the summer they do best when plunged outside but covered with lath racks. They may be kept with auriculas. During the winter they may be kept with ericas at 40–45° at night, and they will come in at Easter without forcing. They are rather slow-growing plants for a commercial man, but they probably will become profitable. *P. decussata*, especially, is one of the finest of pink greenhouse shrubs.

H. D. DARLINGTON.

The following are all natives of Australia, except when otherwise stated:

INDEX.

arenaria, 9.
decussata, 13.
drupacea, 2.
ferruginea, 13.
glauca, 6.
graciliflora, 8.
hypericina, 3.
imbricata, 16.
ligustrina, 4.
linifolia, 7.
longiflora, 1.
nivea, 12.
rosea, 10.
spathulata, 15.
spectabilis, 14.
suaveolens, 5.
sylvestris, 11.

A. *Involucral lvs. absent* .... 1. **longiflora**
AA. *Involucral lvs. reduced to 2 small bracts* .... 2. **drupacea**
AAA. *Involucral lvs. 4–8.*
  B. *Lvs. distinctly penniveined.*
    C. *Fls. white* .... 3. **hypericina**
      4. **ligustrina**
    CC. *Fls. rose-colored or yellowish.* 5. **suaveolens**
  BB. *Lvs. not penniveined or very obscurely so.*
    C. *Color of involucral lvs. green.*
      D. *Fls. white.*
        E. *Perianth-tube cylindrical*.................. 6. **glauca**
          7. **linifolia**
        EE. *Perianth-tube wider at top*.................. 8. **graciliflora**
        EEE. *Perianth-tube narrower at top*................ 9. **arenaria**
      DD. *Fls. rose-colored.*
        E. *Perianth-tube cylindrical*..................10. **rosea**
        EE. *Perianth-tube wider at top*..................11. **sylvestris**
      DDD. *Fls. white and pink in same head*.............12. **nivea**

OO. *Color of involucral lvs. pink or red, or tinged only at margin.*
D. *Fls. rose-colored*..........13. **ferruginea**
DD. *Fls. white and pink in same head*..............14. **spectabilis**
DDD. *Fls. pale yellow* ....15. **spathulata**
AAAA. *Involucral lvs. 8 or usually more than 8*........................16. **imbricata**

1. **longiflòra,** R. Br. Stems 4 ft. or more high, slender, very leafy: lvs. sometimes alternate, linear, hairy: fls. pure white, hairy externally, long and slender: heads globose, many-fld.: anthers yellow, not exserted. B.M. 3281.

2. **drupàcea,** Labill. A straggling shrub 6–8 ft. high or lower: branches leafy: lvs. ovate to oblong-elliptical or oblong-linear, glabrous above, slightly silky hairy beneath, distinctly penniveined: fls. white or tinged with pink, silky hairy, small; anthers yellow, hardly exserted: heads sessile, few-fld. L.B.C. 6:540.

3. **hypericina,** A. Cunn. Stem slender, 3 ft. or more high: branches not very leafy: lvs. elliptically oblong, smooth: fls. hermaphrodite and female on distinct plants, very hairy externally; hermaphrodite fls. longer and more slender: heads many-fld. and crowded.—Very similar to *P. ligustrina*, in fact placed as a variety of it in Flora Australiensis; distinguished in having more involucral lvs. much shorter than the fls. and silky pubescent or hoary. B.M. 3330.

4. **ligustrina,** Labill. Erect, 5–6 ft. high: lvs. ovate to oblong or elliptical: involucral lvs. 4, very rarely 5 or 6, as long as the fl.-tubes, glabrous: fls. sometimes female only, silky hairy. Int. into Calif., where it is said to do very well. B.R. 21:1829.

5. **suavèolens,** Meissn. Erect, usually less than 1 ft. high, sometimes branching at base only: branches very leafy: lvs. ovate-lanceolate to oblong-linear; involucral lvs. 4–8, usually as long as the fls. and ciliate: fls. yellowish when fresh, usually hairy; heads globular, very large and many-fld. B.M. 4543 (as *P. macrocephala*).

6. **glaùca,** R. Br. Erect, much branched, ½–1½ ft. high: lvs. ovate to oblong-lanceolate or almost linear; involucral lvs. usually 4, shorter than fls.: fls. silky hairy: heads globular, not many-fld. L.B.C. 17:1611.

7. **linifòlia,** Sm. Erect, from less than 1 to 3 ft. high: branches slender, bark ferruginous, not very leafy: lvs. linear or oblong; involucral lvs. 4, nearly as long as fls.: heads terminal, globular, erect. B.M. 891.

8. **graciliflòra,** Hook. Erect, slender, 2½ ft. high: lvs. lanceolate, dotted above; involucral lvs. 6, shorter than fls.: fls. long, slender, glabrous.—Very similar to *P. sylvestris*, and described as the same in Fl. Anat.: distinguished from it by narrower lvs. dotted above, and more slender pure white fls. B.M. 3288.

9. **arenària,** A. Cunn. Small, erect shrub, dichotomously branched: lvs. ovate, obscurely downy above, silky hairy beneath; involucral lvs. not different from stem-lvs.: fls. silky on outside; anthers and style not protruded beyond perianth-tube: heads few-fld. and sessile. New Zealand. B.M. 3270.

10. **ròsea,** R. Br. Erect, small: branches sparsely leafy: lvs. linear-lanceolate, glabrous on both sides: involucral lvs. 4, as long as fls., ciliate on margins: fls. with long spreading hairs on lower portion of tube, silky on upper portion.—Very closely allied to *P. ferruginea*. B.M. 3721 (as *P. Hendersoni*). B.M. 1458. L.B.C. 1:88.

11. **sylvéstris,** R. Br. Shrub, 2–3 ft. high, copiously branched: lvs. lanceolate or oblong-lanceolate, glaucous; involucral lvs. 4–6, smaller than stem-lvs., shorter than fls.: fls. quite glabrous; stamens and style very much protruded: heads large and many-fld. B.M. 3276. B.R. 19:1582. L.B.C. 20:1965.

12. **nívea,** Labill. Erect, bushy or straggling, 6 ft. or more high: branches and under side of the lvs. white, with a dense tomentum: lvs. ovate or orbicular, glabrous above; involucral lvs. 4–6, larger than stem-lvs.: fls. tomentose or silky: heads globular, terminal, many-fld. B.R. 24:24 (as *P. incana*). F.C. 1:9.

13. **ferruginea,** Labill. (*P. decussàta,* R. Br.). Stunted, much branched, from less than 1–3 ft. high: lvs. ovate or oblong, firm; involucral lvs. 4, orbicular, glabrous, shorter than the fls.: fls. hairy, lower portion hispid, upper silky: heads terminal, globular. Cult. in Calif. L.B.C. 13:1283; 18:1708 (as *P. diosmifolia*).

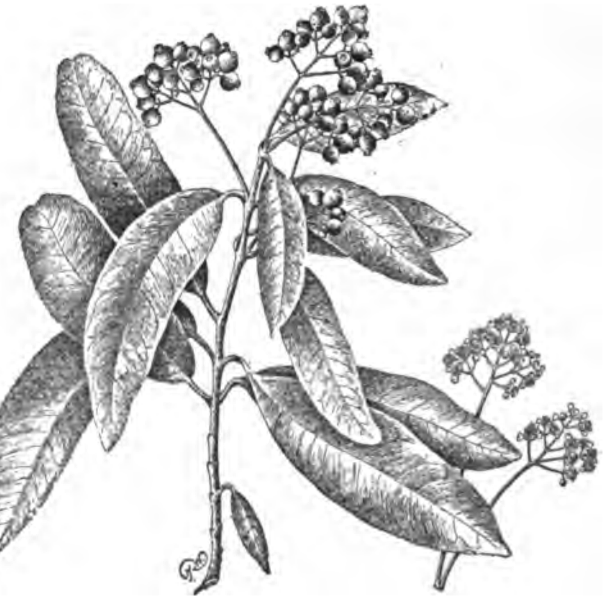
14. **spectábilis,** Lindl. Erect, 3–4 ft. high: lvs. crowded, linear-oblong or lanceolate: involucral lvs. 4–6, ovate or ovate-lanceolate, half as long to nearly as long as the fls., usually tinged only at margins: fls. white after expansion, hairy outside; heads very large, globular, many-fld. B.R. 27:33. B.M. 3950.—A very handsome, showy plant, cult. by H. D. Darlington, Flushing, L. I.

15. **spathulàta,** Labill. Much branched, 2–3 ft. high: lvs. linear to linear-oblòng; involucral lvs. ovate, glabrous, sometimes not colored: fls. silky hairy, much resembling *P. linifolia:* heads large, globular, many-fld. and nodding. F.C. 2:72 (as *P. cernua*).

16. **imbricàta,** R. Br. Small, erect, much branched, from less than ½–1½ ft. high, usually clothed with long, silky hairs, but sometimes glabrous: lvs. usually crowded, alternate or opposite, oblong-lanceolate to linear; involucral lvs. similar to stem-lvs., much shorter than fls.: fls. white, outside hairy; tube cylindrical, heads terminal, globular, many-fld. B.M. 3833 (as *P. nana*).

ARNOLD V. STUBENRAUCH.

PIMÉNTA (from the Spanish *pimento*, allspice). *Myrtàceæ.* The genus containing the Allspice is a group of 4 species of highly aromatic trees native to the West Indies, with large, leathery, feather-veined, long-stalked lvs. which are black-dotted beneath, and numerous small white fls. borne in terminal or axillary, trichotomous cymes. As a genus Pimenta is distinguished from its near allies (Eugenia, Myrtus) by the circular or spiral embryo and the 2-celled ovary with 1–6 ovules pendulous from the apex of each cell. Other generic characters: calyx-tube top-shaped; petals 4–5; stamens numerous: drupe 1–2-seeded.



1804. Allspice—Pimenta officinalis (× ⅓).

Allspice is the unripe berry of *P. officinalis*, which is gathered and dried in the sun. Its name comes from the idea that Allspice combines the flavors of clove, cinnamon and nutmeg. Allspice is common in the wild in Jamaica, inhabiting limestone soil. It is more extensively cult. in Jamaica than anywhere else. It is cult. up to 4,000 ft. The plant is not offered in the American trade, but there seems no reason why it could not be cult. in Porto Rico.

officinàlis, Lindl. (*P. vulgàris*, Lindl.). ALLSPICE. PIMENTO. Figs. 1804, 1805. Distinguished from the other species by the oblong lvs., 4-lobed calyx and globose drupe. Tree, 30–40 ft. high: lvs. 2–6 in. long; petiole ½ in. long: fls. 3 lines long: drupe 3 lines thick. The male Pimento is a form with the female organs less developed. B.M. 1236 (as *Myrtus Pimenta*, var. *longifolia*).

1805. Flowers of Allspice (× 2).

P. àcris, Kostel, called Bayberry, Black Cinnamon and Wild Clove, where cult. in the Orient, is distinguished by the 5-lobed calyx, ovoid drupe and the veins of the lvs. rather prominent above. B.M. 3153 (as Myrcia acris). Yields oil of myrcia, the basis of bay rum.—*P. Piménto*, Griseb., is distinguished by the obovate lvs., 5-lobed calyx, ovate-oblong drupe and lvs., with veins obsolete above.

PIMPERNELL. Properly *Anagallis*.

PIMPINÉLLA (possibly from Latin *bipinnula*, bipinnate). *Umbellíferæ*. About 70 species of herbs, one of which has been described under *Anise*. Lately *P. integerrima*, Gray, has been offered by one dealer in hardy native plants. It differs from Anise in being a perennial plant with lvs. 2–3-ternate and segments entire. B.B. 2:526.

1806. Pinanga Kuhlii.

PINÁNGA (Malay name). *Palmàceæ*. About 25 species of slender, spineless, bamboo-like palms from India and the Malay Archipelago. Lvs. terminal, unequally lobed or pinnatisect, or simple and bifid at the apex; segments plicate, many-nerved, the lower ones acuminate, the upper confluent, the margins not thickened, recurving at the base; rachis acute above, convex below; petiole convex above; sheath elongated: spadix usually small, very simple: peduncle short: branches in groups; spathe 1, symmetrical, swollen or compressed and 2-winged: fls. rather small: fr. ovoid or elliptical, orange or red. For culture, see *Palms*.

Kùhlii, Blume. Fig. 1806. Stems tufted, 20–30 ft. high, slender: lvs. 3–4 ft.; lfts. many, 1–2 ft., falcate-linear to linear-lanceolate, finely acuminate, strongly 2–3-ribbed, upper confluent; petiole variable in length, somewhat scurfy: fr. ½ in. long, shortly apiculate. Sumatra, Java.

grácilis, Blume (*Arèca grácilis*, Roxb.). Stems 6–20 ft. high, 3–4 lines in diam., thickening upwards, usually gregarious: lvs. 3–4 ft. long, sparingly pinnate; petiole and sheaths scurfy; lfts. inserted by a very broad base, 1 ft. or more long, the lower ones 2–3-ribbed, finely acuminate, the upper 3–5 in. wide, many-ribbed: fr. ½ in. long, scarlet or orange, smooth, tapering to the tip. Himalayas, Burma. JARED G. SMITH.

PINCENECTÍTIA. See *Nolina*.

PINCKNÈYA (Charles Cotesworth Pinckney, of South Carolina, 1746–1825, distinguished statesman and general of the American Revolution). *Rubiàceæ*. This includes the Fever Tree or Georgia Bark, a tall shrub or small tree with fls. in large terminal cymes, native to the marshy banks of streams in the pine barrens from S. C. to Fla. Its showy flower-cluster attains a breadth of 4 in. and depth of 3 in., with as many as 20 fls., each 1 in. long, tubular, white, speckled red, with 5 revolute lobes. But the distinctive feature of the Fever Tree, both botanically and horticulturally, is the presence of 5 or more large, showy colored floral leaves. These are 2 in. long, 1–1¾ in. wide, oval or roundish, acute, narrowed at the base, and peach-yellow margined with rosy red. The interesting feature of these floral lvs. is that they are not bracts, but modifications of one of the calyx-lobes, which are normally small and awl-shaped. Only one other species of this genus is known, *P. ionantha* from Colombia. The Fever Tree has been cult. in Europe under glass, but it is rarely successfully cult. in America.

pùbens, Michx. GEORGIA BARK. FEVER TREE. BITTER BARK. Attains 25 ft.: lvs. oval or oblong, acute, 4 x 1½ in.; midrib rosy: calyx 5-lobed; lobes deciduous or one of them in the outer fls. often transformed into a showy floral lf.; corolla hairy; stamens 5, exserted, stigma obtuse: capsule globose, papery, 2-celled; seeds numerous, in 2 rows, horizontal, winged. F.S. 19:1937. S.S. 5:227–8.—*Pinckneya pubens* grows in low marshy woods and on borders of swamps. It thrives best when shaded by other trees. Seedlings require very rich moist soil and should always be grown under shade. They are difficult to keep alive if exposed to direct sunlight until 4 or 5 feet high; then give partial shade.

P. J. BERCKMANS and W. M.

PINE. What the apple is among the fruits, what the oak is among the broad-leaved trees of the temperate zone, the Pines represent among the conifers, excelling all other genera in this most important family in number of species, in fields of distribution, in extent of area occupied, in usefulness and importance to the human race. No other trees of the temperate zone have contributed so much to the building up of civilization and no other, it may be predicted, will continue longer to fill the important place in the household of civilized man; for not only do they in a number of species furnish the most satisfactory qualities of wood for structural purposes, but their frugality in regard to soil conditions will preserve them a place as wood-producers in many of the poor sites, when the lands fit for agricultural use have all been turned over to food production.

Among the 70 or more well-distinguished species—over 600 species and varieties of Pinus have been described—all inhabitants of the northern hemisphere, ranging from the arctics through plains and mountains to near the equator, occurring in the tropics at least on high mountains, a variety of adaptation, of form, of usefulness, may be found to satisfy every requirement; and since more than half the number of species (about 40) are indigenous to North America or the United States, it is hardly necessary to go out of our own country for plant material.

For economic importance as well as a combination of points of excellence in all directions, ornamental as well as useful, rapidity and quantity of production and adaptability to climate and soil, the chief place belongs to our White Pine (*P. Strobus*), and next in importance stands the Longleaf Pine (*P. palustris*) of our southern states. The Red Pine (*P. resinosa*), the Shortleaf (*P. echinata*), the Loblolly (*P. Tæda*), with the Cuban Pine (*P. Cubensis*), add their stores to the enormous quantities furnished annually by the first and second. In our western mountains the Bull Pine (*P. ponderosa*), the Sugar Pine (*P. Lambertiana*), and the Silver Pine (*P. monticola*) are our large timber Pines; and in Mexico *P. Ayacahuite* replaces our White Pine, and *P. Arizonica* and *Montezumæ* are the important yellow Pines. In our Philippine possessions one species, *Pinus insularis*, forms important mountain forests. In Europe the Scotch Pine (*P. sylvestris*) furnishes the bulk of supplies, with *P. Laricio* in the more southern countries. In Japan and northern China *P. densiflora* and *Thunbergi* and in the Himalayas *P. excelsa* and *longifolia* are the important species.

Besides the timber, several of the species furnish from their resinous contents naval stores, turpentine, tar and pitch, the bulk of which is now still derived from our own Longleaf Pine. Pine wool is made from the leaves of this and other species, essential oils are distilled from leaves and young shoots and used medicinally, and the seeds of the Nut Pines are used for food and flavors. While the economic importance of the genus can hardly be overrated, the ornamental value is undoubtedly less than that of other genera like the spruces and firs. Nevertheless, at least interest and picturesqueness, if not beauty and symmetry of form, attach to a large number of species.

1807. Pinus ponderosa.
Young trees in Colorado.

Choice of material for planting with such a wealth of species is difficult; yet climatic limitations reduce the number that may be grown within each climatic zone, and further assistance in the choice may be found in the fact that the botanical division of the species into three groups; viz., White Pines, Yellow Pines (so called from the color of the wood) and Nut Pines, denotes at the same time differences of habit and form.

In no other group, perhaps, is it so necessary to keep in mind that form and habit change through the different periods of life from the juvenile through the adolescent to the virile and senile stages of development; while symmetrical and pleasing in their youth and grand or picturesque in their age, in their intermediate stages the trees may be straggling and unsightly. Starting in its youth with the pyramidal aspiring habit of all the conifers, the shaft dominating over the branch system and the latter surrounding the former in regular whorls, later on the symmetry is disturbed and finally the towering old Pine may have its bole split up into many stout branches and the crown may have broadened and flattened or rounded off in the umbrella-like fashion which the Stone Pine (*P. Pinea*) exhibits so strikingly in the Italian landscape. This flattening of crown is characteristic of most Yellow Pines, while the piñons or Nut Pines have a tendency to the broom-like or apple tree appearance. Of our eastern species, the White Pines alone preserve to some extent the conical habit of the crown in imitation of the spruces with more or less symmetrical horizontally spreading branches, which render them pleasing objects throughout all periods of life. On the Pacific coast a number of species preserve the conical form.

In the choice and combination of plant material we should keep in mind that the Pines are essentially light-needing species, hence do not bear overtopping or crowding unless they have a chance by their rapid growth in height to escape from the pressure of their shade-making neighbors; the White Pines, especially *P. Strobus* with its denser foliage, is more tolerant of shade than others; the dwarf *P. montana* is also tolerably shade-enduring.

In each of the three groups there are rapid growers (in height) and slow growers, although all are slow during the first 2–7 years.

Our common White Pine (*P. Strobus*) and the Cuban Pine (*P. Cubensis*), with the European, Scotch and Austrian Pines, are good examples of the first class, making under favorable conditions annual shoots of 1–2 ft. for a number of years; while the Swiss Stone Pine (*P. Cembra*) and other Pines of high altitudes, like *P. flexilis* and *albicaulis*, are examples of slow growers. There are persistent growers reaching great heights, and laggards, remaining dwarfs or medium-sized trees; again our king of Pines, the common White Pine, and its giant congener the Sugar Pine, with the Bull Pine in favorable situations, take first rank, the first with a maximum height of 160 ft. and more, the last with over 200 ft., while many of the so-called Scrub Pines, like *P. Virginiana*, *serotina*, *divaricata*, etc., the Alpine White Pines *P. flexilis*, *aristata*, *Peuce*, *pungens*, *densiflora*, and most Nut Pines reach rarely over 40 ft.; some, like *P. Koraiensis*, *Bungeana*, *montana*, with several of the nurserymen's varieties, remaining actually dwarfs and maintaining a compact, bushlike appearance for a long time.

In regard to foliage, quite a large variety can be had. For grace and elegance nothing better again than our five-needled silver-lined White Pine can be suggested, although *P. excelsa* from the Himalayas, with its slenderer and longer branches and more drooping foliage, and the dwarfs *P. Peuce* from Macedonia and *P. Koraiensis*, with their denser and more compact crowns, and some others of the White Pine tribe, may vie with it. Among the Yellow Pines our own almost entirely overlooked *P. glabra* deserves mention in this connection, where the climate permits its use, as well as the interesting Sand Pine, *P. clausa*.

For richness, fulness and vigor of foliage, our Red Pine (*P. resinosa*) outranks even the much-planted more somber Austrian Pine, and for interest in development nothing can compete with our Longleaf Pine (*P. palustris*). With its needles, which in young specimens exceed a foot in length, surrounding in dense, graceful tufts the big silvery buds at the tip of the candelabra-like branches, *P. palustris* offers a most striking appearance. Unfortunately, it is not adapted for planting north of the 32d degree.

The thin, grayish, short foliage of the frugal Banksian Pine and of several other of our Scrub Pines, and the stouter also grayish foliage of the Scotch Pine, make a pleasing color contrast against the somber dark background of spruces and firs, while the short, stiff needles of the Nut Pine *P. edulis* and the interesting one-needle Pine (*P. monophylla*) resemble the spruce foliage. Color of bark varying in species from silvery gray through red and yellow tints to almost black, and character or size of cones from the diminutive globose forms of *P. contorta* to the long, pendulous cones of the Sugar

Pine 2 ft. in length and the hooked ponderous cones of *P. Torreyana* and *Sabiniana*, may also influence choice of material.

1808. Pinus ponderosa.
A mature tree 60–90 ft. high, in dry and shallow Colorado soil.

With wide range of distribution and hence adaptiveness as far as climate is concerned, we have our Shortleaf Pine (*P. echinata*), which is found from Massachusetts to Texas, and in the West our Bull Pine (*P. ponderosa*), which ranges from the moist Pacific coast in Washington to the dry slopes of Arizona. In Europe, the Scotch Pine comes nearest to such wide distribution. Besides our own northern species, there have been found hardy in our northeastern states the Scotch and Austrian Pines *P. Bungeana, Cembra, Koraiensis, montana, Thunbergi*, while the Mexican Pines and those of southern Asia will endure only the light frosts of our southern states. Yet in the parks of Washington, D. C., the following Pines are to be found: *P. Strobus, Cembra, excelsa, Lambertiana, Ayacahuite, Koraiensis, palustris, Tæda, ponderosa, rigida, Laricio, glabra, Virginiana, echinata, montana, Pinaster, edulis, pungens, sylvestris, Massoniana;* and the probability is that most of the other species could find a place there to live if not to thrive. Figs. 1807–1809 show how a species may vary under different conditions.

The list of species hardy in the Arnold Arboretum (Boston) comprises the following:

1. *Thriving well.*

Bungeana,
Cembra,
densiflora,
divaricata,
echinata,
Jeffreyi,
Koraiensis,
Lambertiana,
Laricio,
montana,
monticola,
parviflora,
Peuce,
pungens,
resinosa,
rigida,
Strobus,
sylvestris,
Thunbergi,
Virginiana.

P. excelsa and *P. ponderosa pendula* thrive well in a sheltered place, but are probably not quite hardy here.

2. *Hardy, but not of promising growth.*

Balfouriana, var. aristata,
contorta, var. Murrayana,
edulis,
flexilis,
monophylla.

In the interior middle states the number which would stand the extremes of drought and cold would probably be reduced; a partial list found in the Missouri Botanical Garden is given below:

The best are given first. All of the later ones on the list die out sooner or later, as the city smoke is very detrimental to coniferæ. None do very well on that account.

Mughus (P. Pumilio), Austriaca, Strobus, } 3 best.
Cembra,
rigida,
Virginiana,
resinosa,
Laricio,
sylvestris,
ponderosa.

For seaside planting *P. rigida* has shown itself most fit, and of foreigners in proper climate *P. Pinaster* and *Halepensis*, while *P. contorta* on the northwest coast and the frugal *P. radiata* on the southwest coast are the seacoast trees par excellence.

The Pines are essentially inhabitants of the poor sandy soils and dry situations, their stout root system enabling them to seek the scanty water supplies where other species find it difficult. Some, like the White Pine, are adapted to a variety of soil conditions, but only a few can endure a surplus of water: *P. resinosa* will follow the White Cedar into the swamp and thrive there as well as with the Banksian Pine on the poorest gravels; *P. rigida* is at home both in wet and dry places; the Scotch Pine of the Baltic sand plains may be found in the peat bogs, but only eking out a miserable existence, while *P. Tæda*, the Old Field Pine, makes magnificent trees in the southern swamp, and with its slow growth under such conditions an excellent timber. *Pinus contorta* and *serotina* also are indifferent to water conditions at the root; so is the Cuban Pine, but *P. palustris* belies its name, for it is only very rarely found in poorly drained places and does not thrive there.

The propagation of Pines does not offer any difficulties. The seed usually has a high germination percentage in most species if kept dry and cool, and it retains vitality for several years, deteriorating of course somewhat from year to year. To avoid deterioration in transoceanic shipments, packing in charcoal dust has been found very serviceable. While most of the Pine seeds sprout readily, the White Pine, with some others, has the bad habit of lying over for one year in part, unless treated to a hot-water bath for 24 hours before sowing; or perhaps by sowing in the fall immediately after coming out of the cone, which is during the first two weeks of September. The seeds should be sown in light mold early, rather thinly to permit a good root system to develop, covering then thinly according to size of seed not over ¼ inch, which is best done by sifting sand over the seed with a sieve. During the first year special care is necessary to regulate the water supply and transpiration for the young seedlings; they want to be kept humid, not wet, but resent drought as much as a surfeit; and especially sudden changes from drought to wet are likely to produce "damping-off." To prevent too rapid transpiration the familiar lath screens should be applied.

1809. Pinus ponderosa.
Giant specimens 225 ft. high, grown in the deep, moist soil of the Yosemite valley.

To prevent the formation of excessively long taproots which some species are wont to form, mechanical means may be adopted; but the best plan is to manure near the surface, so that fibrous roots will be formed. Such manure consists of one-third steamed bone meal and two-thirds ammonia superphosphate. Root-pruning and transplanting in nursery rows when 1 or 2 years old is practiced to secure a stocky root system. In Germany one-year-old Scotch Pines are planted by the million for forest purposes, but for ornamental purposes older plants are to be used; yet it is safest not to use them older than 3 or 4 years for permanent situations. In the third year usually the first branching occurs, indicating that the root system is not well established.

In transplanting, the utmost care must be taken not to expose the roots to drying influences, a thin loam puddle answering best to keep them moist. While transplanting can be done at any time of the year, it is safest to do so in early spring, except when a droughty season is apt to follow, when fall planting is to be preferred.

A large number of nurserymen's varieties, dwarf and pendulous, varicolored, etc., have been developed, especially from *P. sylvestris* and *P. Strobus*. The most interesting freaks perhaps are those bushy forms derived from *P. Canariensis* and *Pinea* produced by layering, in which single needles instead of the usual bundles of two in one sheath are produced, imitating the primary single needles of seedlings. The manner in which nurserymen's varieties are propagated by grafts or cuttings is discussed under *Pinus*.

According to the nature of the Pines, if there is choice of location possible the well-drained situations, even dry ones, should be reserved for them. They belong, with few exceptions, to the hill-tops not the bottoms, to the sands not clay soils, and will stand southern exposures better than the spruces.

Pines are frugal by nature, and can stand poverty better than surfeit,—nevertheless they respond best to medium conditions, namely, a mellow surface and well-drained, deep, loamy sand, not too rich in organic matter and loose enough to permit the natural development of the heavy tap-root system. Under such conditions the peculiar rich foliage gives most satisfaction and the rank, luxuriant growth which leads to poor form is checked; disease from fungi is obviated; the cottony scale (almost the only enemy of the White Pine) is more readily fought, and injuries from caterpillars and beetles are more readily repaired.

To prune evergreens, and especially Pines, requires an artist, or else the result will be malformation: the best plan is to correct form by breaking out the center bud from such shoots as project beyond proper limits; thereby also a more compact growth is induced, which in the Pines with their open habit is desirable. If it becomes necessary to top the branches, the cut must remove also the bolster at the base of the branch; the resinous exudation will prevent decay, and the cambium soon covers the scar if the cut has been made properly. For hedge planting the Pines furnish no specially desirable material, being light-needing and therefore thinning out soon in the interior; yet the White Pine will stand as a hedge for a considerable time and also the dwarf *P. montana*. Perhaps some others may answer the purpose.

For the botany of the Pines, see *Pinus*.

B. E. Fernow.

PINEAPPLE. The Pineapple (see *Ananas*) is indigenous to America. It produces one of the most delicious fruits now regularly on our markets. The finest qualities are developed when the fruit is permitted to ripen naturally upon the plant. For distant markets the crop has to be gathered in varying degrees of unripeness to suit the time required in transit.

The amount of importations reached its maximum in 1894; viz., $750,000 worth. Since that time there has been a rapid decline. But for a succession of severe winters our own needs would be supplied from home-grown fruit. In 1894, 4,000,000 "apples" were marketed from Florida plantations; this amount was largely reduced by the freezes of 1894 and 1895. The freeze of Feb., 1899, again reduced the output, so that the crop of 1900 only approximated that of 1894. As a result of these freezes, the plantations are now more carefully protected by sheds and by being placed in frost-favored locations. The year 1850 seems to be the earliest date at which Pineapple-growing was attempted in the U. S. This attempt was made near St. Augustine, Fla., according to Taylor. In 1860 planting was commenced on the Keys, but the want of facilities for rapid transportation and the more favored Cuban and Porto Rican plantations made the development slow. In 1897, $15,000 worth was imported from the Hawaiian Islands, but these islands will not offer enough fruit to seriously affect the eastern market, though the importations will increase largely.

Profits.—Good Pineapple land may usually be obtained from $1.50 to $60 per acre, the higher-priced land being in favored locations, at railway stations and near settlements. The cost of clearing and preparing varies from $20 to $80 per acre, according to the cost of labor and the character of the growth on the land.

From 8,000 to 15,000 plants are needed to the acre, varying with the variety and the notion of the planter. The price of plants in the field varies from $3 per 1,000 for Red Spanish to $350 per 1,000 for the finer varieties. The cost of cultivating and fertilizing an acre for one year varies from about $20 to $150. It takes about 18 months from the time of setting out to the maturing of the first crop, which yields 50–350 crates per acre. Under favorable circumstances the second crop may be double that of the first. By careful attention the plantation may be continued for 8 or 10 years without resetting; the second or third crop frequently bearing the maximum amount of fruit.

When a common variety is planted the returns are mainly from the sale of fruit, but with fancy varieties the sale of plants constitutes the main source of returns. Four hundred dollars or more per acre has been realized frequently for a crop of the commonest varieties; in this case increase in plants cannot be considered as of much value. The value of a crop of fancy fruit is about double that of the common, and $1,000 worth of plants may be sold without detriment to the plantation, if it is a variety that is in demand. From this must be subtracted the cost of transporting to the markets, which varies more or less with the distance the fruit is hauled. This cost varies with the quantity shipped, from $20 to $80 or more per acre.

Soil.—The Pineapple thrives in a variety of soils, but whatever be its texture it must not be moist or wet. The Pineapple plant will survive air-drying for months, but decays rapidly in a moist atmosphere. The greatest acreage is located upon dry, sandy land, formerly overgrown with spruce-pine (*Pinus clausa*) or a mixture of spruce-pine and hardwood. Chemical analyses of the soil from Pineapple fields show an exceedingly small fraction of a per cent of the essential fertilizer ingredients present. A physical analysis shows that the water content is very low. A considerable acreage is located on the Florida Keys. Here there is only a small amount of leaf-mold, often not more than an inch on the average, covering a coralline rock. But for the fact that Pinapples actually grow and make crops on such soil it would seem entirely incredible.

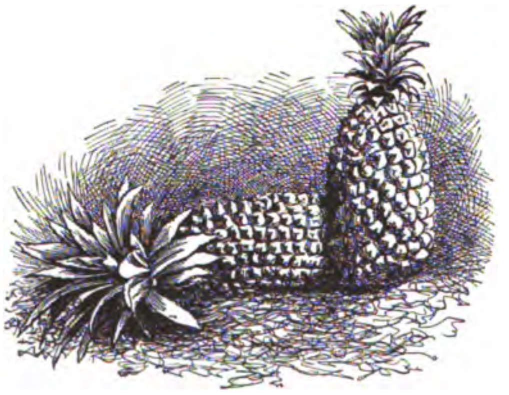
Fertilizers.—With conditions of soil as described above, it is imperative to fertilize, and under the existing conditions in the Pineapple belt there is no other remedy than the addition of commercial fertilizers, and nothing better. While much is still to be learned about fertilizing this crop, it is fairly well established that for Pineapples on spruce pine land dried blood, ground bone, and nitrate of soda are good sources of nitrogen; that low-grade sulfate of potash, carbonate of potash and high-grade sulfate of potash are good sources of potash; that acid phosphate should be used in small quantities only or avoided, using pulverized bone instead. A good plan for fertilizing is to drop a small handful of cotton-seed meal into the bud immediately after setting out. In October, apply about 600 lbs. blood and bone and 400 lbs. lowgrade sulfate of potash (not kainit) per acre, or the equivalent of these fertilizers in some of the forms mentioned above. A second application may be made in the following February; at this time the amount may be increased 10 to 25 per cent, according to the growth the plants have made. A third application may be made in June or July; and if the plants have grown vigorously a still further increase in amount may be made. A fourth application may be made in October, increasing the amount if the plants have grown vigorously. The succeeding applications may be made at the time suggested above, and the increasing and decreasing of the amounts may be determined by the progress of the plants. As the average spruce-pine Pineapple land is not sufficiently fertile to grow a full crop of Pineapples, much more depends upon proper fertilizing than any other one operation.

Propagation.—This plant is propagated by means of crowns, slips, suckers and rattoons. The crown is the leafy portion of the fruit as found in the market. Just below the fruit small plants form, which are left in the field when the fruit is gathered; these are known as slips. In the axils of the lvs. buds occur; those that develop near the ground make strong plants in a few months and are known as suckers. A strong plant will mature an "apple" in June and produce 2–5 suckers by the middle of September. Buds which develop from a portion of the plant under ground and form a root system independent of the parent plant are known as rattoons. Crowns are not planted extensively, as they remain on the fruit when marketed. Good strong suckers are usually employed for planting out. Rattoons are left in the field to replace the plants which have borne a crop, but they are not sufficiently numerous to make a full stand; hence some of the suckers must be left also. Slips require a year longer than suckers to mature a crop. According to Webber, it takes 10–12 years to mature a plant from seed. Plants are raised from seed only for breeding purposes.

Preparation of the Land.—If spruce-pine land is prepared it is cleared of all stumps, wood, roots and any other organic material, and is plowed deep and leveled off smoothly. The fields are then laid off in beds of 6 or 8 rows wide, depending on the variety. The beds should be narrow enough to permit fertilizing and working with a scuffle hoe without entering the beds, as breaking the lvs. is very detrimental. For Red Spanish the rows are made 18–20 in. apart; for Queens 20–22 in.; for Porto Ricos 30–36 in. They are usually placed in checks of about the same distances.

The methods employed on the Keys are quite different. The land is cleared by cutting off the trees, shrubs, etc., which are allowed to dry and are then burned. The plants are then set out with a grubbing hoe; they must be set out irregularly, as the rocky soil does not furnish root-hold everywhere. Such fields become exhausted in a few years and have to be abandoned.

Tillage.—This operation consists in running over the ground with a scuffle hoe. Where the plantation is set out in beds the handle of the hoe is long enough to permit cultivating to the middle without the laborer entering the bed. Only about an inch of the surface soil is agitated, usually immediately after the fertilizer has been applied. Weeds are not troublesome, excepting in fields that have been cultivated a long time. Under sheds tillage is more frequent and appears to be more necessary. On the Keys no tillage is possible, but tall-growing weeds and such ligneous plants as may spring up are cut off. In all of the work among Pineapple plants the greatest care should be exercised to avoid breaking the lvs., which are very brittle.



1810. The Queen Pineapple.

Marketing.—The fruit is picked a week before it would mature. It is packed at once into barrel (12 x 20 x 36 in.) and half-barrel (12 x 10 x 36 in.) crates, usually in the latter, the different sizes being packed in separate crates and designated as 18's, 24's, 30's, 36's, 42's, 48's and 54's, according to the number required for a half-barrel crate. The fruit must be handled without being bruised and packed firmly to prevent its abrasion in transit. To protect the fruit each one is wrapped separately in brown paper.

1811. The Enville Pineapple.

Varieties.—Since the propagation is carried on by means of offsets, the varieties are fairly stable and quite definitely marked. The variety most extensively grown is called Red Spanish, Spanish or Reds. It has a medium-sized apple, and is a hardy plant. Abachi (Abakka), Blood, Queen (Fig. 1810), Sugar Loaf, Enville (Fig. 1811) and White Antigua are varieties that produce medium-sized apples of excellent quality. Black Jamaica, Black Prince, and Prince Albert produce large apples of excellent quality. Smooth Cayenne produces a large apple of good quality. Porto Rico produces a very large apple of good quality. There are other varieties grown more or less extensively and other names for the above-named varieties, but the foregoing have been officially recognized by the Florida State Horticultural Society.

Pineapple Sheds.—It has been found very advantageous to build a shelter for "pines"; in the winter a shed protects the plants from too great radiation of heat, and in the summer it reduces the intensity of the sun. The original object of the shelter was to protect the plants from frosts and freezes. Pineapple plants freeze at 32° F. This degree of cold does not kill the heart of the plant, but only the larger portion of the lvs. Pines under sheds have passed through a temperature of 25° F. without serious injury. The roof of a shed is usually flat, or undulating with the surface of the land. The height varies with the desires of the individual, but is usually about eight feet above the ground.

In Fig. 1812 the roof is slightly less than 7 ft. from the ground. The stringers running crosswise in the figure are 1½ x 3 x 21; those running lengthwise are 1½ x 1½ x 15. The material for the roof is cypress plastering lath of usual length and width. The stringers running lengthwise are 46 in. apart. The openings between the lath are just the width of a lath. The amount of lumber needed (per acre) is about as follows:

414 posts (352 for roof, 72 for sides) 4′ x 4′ x 8°.
160 pieces 1½′ x 3′ x 20°.
960 pieces (840 for roof, 120 for sides) 1½′ x 1½′ x 15°.
80,000 lath (75,000 for roof, 5,000 for sides) ⅜′ x 1′ x 4°.

It takes about 9,000 feet of lumber for the above material exclusive of the lath. All lumber must be first-class and free from knots. This can still be reduced by about 2,500 feet by using wire in place of the 1½′ x 1½′ x 15° and weaving the lath in this. Under the most favorable circumstances such a shed can be erected for $450 per acre, but this is about the cheapest and lightest form that will withstand the elements.

Diseases and Insect Enemies.—(1) Heart rot; bitter heart: The cause of this disease is not known, but it seems to be more prevalent during a rainy season than during a dry one. It manifests itself by the portion around the heart taking on a water-soaked appearance. This condition progresses outward until the whole apple is involved. It is not necessarily accompanied by rotting, though this usually follows. The whole apple becomes bitter, even before it is entirely involved. When this disease is present in a field the fruit should be marketed as soon as possible, that the apples may be consumed before becoming badly affected.

(2) Sanding: This disorder occurs immediately after setting out, especially if a long dry spell occurs at this time. It is produced by sand being blown into and filling the bud of plants. Immediately after setting out drop into the bud a small handful of cotton-seed meal, or the same amount of a mixture of 1 part ground tobacco stems and 3 or 4 parts cotton-seed meal. This soon forms a firm plug in the bud, keeping out sand but not interfering with growth. Blood and bone, or blood, bone and tankage, may also be used.

(3) Spike; longleaf: This disease manifests itself by the lvs. failing to expand at the base, thus giving the plant a contracted appearance. The outer portion of the leaf spreads from the center of the plant, but usually fails to take on a broad, flat, healthy appearance. Experiments have proved that this disease may be produced by improper use of commercial fertilizers, though the disease has occurred where no fertilizer had been used. Abundant evidence is at hand to show that the disease is not due to an organic agent but rather to untoward condition in the soil. Change the fertilizer, avoiding acid phosphate, kainit and cotton-seed meal in large quantities, and give protection as by a Pineapple shed (spike is a rare thing under sheds).

(4) Blight; wilts: This disease occurs in a sporadic manner, usually without any apparent regularity. In some varieties the first intimation of blight is by the outer end of lvs. turning red, and later by the tips wilting. This wilting progresses until the entire plant has dried up. According to Webber the direct cause is a soil-inhabiting fungus which attacks the roots. Remove the wilted plants and set in healthy ones. If the plants are of valuable varieties trim off all diseased roots and much of the stem, together with larger lvs., and reset. It is probable that the fungus will not survive until the roots again penetrate the soil.

1812. Pineapple shed in Florida.

(5) Red spider (*Stigmæus Floridanus*, Banks): This species attacks the tender white portion at the base of the lvs. The effect upon the plant is greatly out of proportion to the small amount of injury to the parts attacked. In later stages the lvs. rot off at the place attacked. Drop a small handful of tobacco dust into the bud of the plants. Subsequent rains and dews leach the tobacco and carry the solution down to the red spider. If they are not all dead in a week or ten days, repeat the dose.

(6) Scale insect (*Diaspis bromeliæ*): This scale insect becomes troublesome in dry localities and in greenhouses. The insect usually attacks the lower surface of the leaf, but each point of attack shows through as a yellow spot on the upper surface. Spray with resin wash, resin compound, kerosene emulsion or whale-oil soap.

(7) Mealy bugs (*Dactylopius citri* and other species): These insects attack the base of the lvs. just at or below the ground level; also the bud, and when fruit matures they multiply in great numbers among the slips and in the eyes of the fruit itself. The remedy is the same as for scale insects, but it is very difficult to make the application effective. When the mealy bugs are present before the fruit-bud forms much good can be done by applying a large handful of tobacco dust in the axils of the lvs.

Pineapple culture is also discussed under *Florida*.

P. H. Rolfs.

PINEAPPLE AIR-PLANT. *Tillandsia utriculata.*

PINEAPPLE FLOWER. *Eucomis punctata.*

PINE, DAMMAR. See *Agathis.*

PINE, KAURI. See *Agathis.*

PINE, MORETON BAY. See *Araucaria.*

PINE, NORFOLK ISLAND. See *Araucaria.*

PINE, SCREW. See *Pandanus.*

PINÉLLIA (after Pinelli). *Aràceæ.* Three species of hardy perennial tuberous herbs, native to China and Japan. Foliage appearing with the fls.: lvs. 3 or pedatisect: peduncle solitary: spathe marcescent: fls. monœcious in the appendiculate spadix, all fertile; perianth none; male fls. with 1 stamen; female fls. one-sided: ovary 1-celled; ovule solitary, orthopterous. See Engler, in DC. Mon. Phan. 2:565.

tuberifera, Ten. Adult lvs. 3-cut, the middle segment 1⅓–2 times longer and wider. China.—There is a variety with narrower leaf-segments and another with lvs. cut into 5 segments.

PINEY. Old-fashioned name of Peony.

PINGUÍCULA (diminutive of Latin *pinguis*, fat; referring to the succulent and greasy foliage). *Lentibulariàceæ.* Butterwort. About 30 species of small, swamp-loving herbs of carnivorous habits with pretty long-spurred fls. something like a snapdragon. They grow in tufts or rosettes with several scapes less than a foot high, each bearing a solitary flower. The lvs. are more or less short, thick, succulent, and densely covered with crystalline, glandular hairs, which give the lvs. their buttery feeling. Small insects are caught on these sticky hairs, and the margins of the lvs. roll in and cover them. D. T. Macdougal writes: "A digestive fluid, probably a trypsin, exudes from the surface of the leaf which dissolves the bodies of the insects, allowing the substances of which they are composed to be absorbed by the leaf. The leaves of Pinguicula also contain vegetable rennet, and Linnæus mentions that the leaves of *P. vulgaris* were used by the Lapland tribes for curdling milk, and Pfeffer says the same custom prevails among the peasantry of the Italian Alps."

Pinguiculas make dainty flowering plants in pots; although natives of northern countries, they can scarcely be considered hardy subjects, as they require special treatment. The choicest species are undoubtedly *P. lutea* and *P. caudata*. *P. lutea*, a native of our low pine-barrens from N. C. to Fla. and La., is unique in the genus by reason of its yellow fls., while *P. caudata*, with its rich purple fls., is the finest of all those which range from violet and purple through rose and lilac to whitish. The charm of *P. caudata*, aside from its color, lies in its extraordinarily long spur, which attains 2 in., while the 5-lobed limb reaches an equal length. These plants are scarcely known in America outside of botanic gardens. F. W. Burbidge has given a detailed account of his success with *P. caudata* in Gn. 22, p. 309: The spring and summer foliage are scarcely recognizable as belonging to the same plant. In early spring the lvs. are numerous, small, short, thick and pointed, forming a dense rosette like an Echeveria; in midsummer the lvs. are large, thin, obovate and lax. The plant blooms freely in both stages, but produces the largest fls. later. In the fall the foliage again becomes a bulb-like mass of fleshy lvs., and so rests all winter. Burbidge found that the plants can be readily propagated by these fleshy lvs., each one producing a new plant, as in the case of the bulb scales of certain common lilies. These leaf cuttings were placed by Burbidge in the live sphagnum of orchid baskets. Young plants were potted in 2½-in. pots of live sphagnum, using small crocks only. These small pots may then be plunged in small shallow orchid pans to prevent extremes of moisture and hung up in the cool end of a Cattleya house. Burbidge has also grown *P. hirtiflora* in pans of sphagnum standing in a saucer of water and treated to the hottest sunshine. The fls. are said to last 8 or 9 weeks.

Pinguicula belongs to the same family with Utricularia, a group composed largely of aquatic plants which capture minute creatures in little bladders that are developed on the thread-like lvs. Pinguicula differs in the more terrestrial habit, the 4–5-parted calyx, spreading position of the posterior lip of the corolla and also in the anthers. Pinguicula is one of the very few dicotyledonous plants with only 1 seed-leaf. The fls. of Pinguicula are often reversed before and during anthesis.

A. *Color of fls. yellow.*

lùtea, Walt. Unique in the genus by reason of its yellow fls. and nearly regular (not 2-lipped) corolla. Exceedingly variable in the size of all its parts, and in the obtuse toothing of the corolla-lobes. Scapes 5–12 in. high: fls. ½–1½ in. long and broad; spur curved, about as long as the rest of the corolla; throat spotted and belly lined with red; palate very prominent and densely bearded. Low pine barrens, N. C. to Fla. and La. B.M. 7203 (most of the lobes 4-cut, the middle cut being deeper). B.R. 2:126 (2 upper lobes once-cut, 3 lower lobes 4-cut).

AA. *Color of fls. purple to lilac.*

B. *Spur 3 or 4 times as long as the rest of the corolla.*

caudàta, Schlecht. Scapes 5–7 in. high: fls. deep bright violet-purple, attaining 2 in.; lobes all rounded except the middle one of the lower lip, which is retuse. Mexico. B.M. 6624. Gn. 23, p. 309.

BB. *Spur about as long as the rest of the corolla.*

C. *Fls. ¾–1 in. long and broad.*

grandiflòra, Lam. Scapes 3–8 in. long: fls. "blue, rarely purplish violet," according to DC., 10–15 lines long, 9 lines broad (3 or 4 times longer than in *P. vulgaris*); lobes undulate; palate with 1 or 2 white spots; spur straight, a trifle shorter than the broadly funnel-shaped tube. Western Eu. G.C. III. 10:373.—According to Bentham, this is a large-fld. var. of *P. vulgaris*, with longer spur and broader lobes, which in the western part of Eu. passes into the common form.

hirtiflòra, Tenore. Scapes 3–4 in. high: fls. 8 lines long and broad, lilac or rose (blue according to Tenore, and shown as purple in B.M.), with a white tube; spur straight or curved, about as long as the rest of the corolla. S. Eu. B.M. 6785. Gn. 25, p. 290.—Possibly distinguished from *P. grandiflora* by the color of the tube, which is white outside and yellow in the throat. According to Burbidge there is a var. with pure white fls.

CC. *Fls. ½ in. long and broad.*

vulgàris, Linn. According to Hooker, this differs from *P. hirtiflora* in the bright blue color and the retuse lobes of the corolla, as also in the less globose capsule: scapes 1–5 in. high: fls. bluish purple ("blue," writes Hooker), about 6 lines long; spur nearly straight, about 2 lines long or as long as the rest of the corolla. Wet rocks, Eu., Asia, N. Amer. Gn. 57, p. 335.—Sometimes called Labrador Violet.

W. M.

PINK. See *Dianthus;* also *Carnation.*

PINK MULLEIN. *Lychnis Coronaria.*

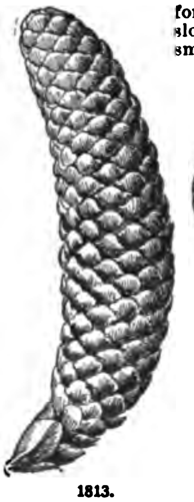
PINKROOT. *Spigelia.*

PINKSTER FLOWER. A wild Azalea, *A. nudiflora.*

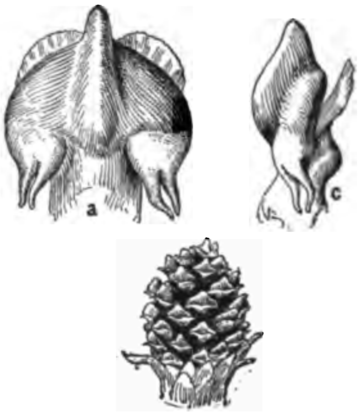
PÌNUS (ancient Latin name). *Coniferæ.* PINE. PINE-TREE. Evergreen resiniferous trees, usually tall, rarely shrubby, with spreading branches forming a pyramidal or round-topped, in old age often very picturesque head, and clothed with acicular lvs. in clusters of 2–5, rarely solitary: fls. catkin-like, appearing in spring; staminate yellow or purple, often conspicuous by their abundance; pistillate greenish or purplish, developing into subglobose to cylindric, usually brown cones, which sometimes attain 18 or more inches in length, ripening mostly not before the second or rarely the third year. The Pines are among the most important timber trees of the northern hemisphere, and many of them are valuable for the decoration of parks and gardens.

A great number of the species are hardy north. Among the hardiest are *P. Strobus*, *Cembra*, *parviflora*, *Bungeana*, *Koraiensis*, *rigida*, *divaricata*, *Thunbergi*, *resinosa*, *sylvestris* and *montana*. The Mexican species and those from southern Asia stand only a few degrees of frost. The degree of hardiness is mentioned with the description of each species.

Young Pines are with few exceptions of more or less regular, pyramidal habit; but in old age they are often very picturesque, especially *P. Strobus*, *radiata*, *rigida*, *Pinea*, *Cembra*, *Laricio*, *parviflora* and others. Of very graceful habit, with slender branches and drooping foliage, are *P. excelsa*, *Ayacahuite*, *Montezumæ*, *longifolia*, and *Canariensis*, but they are all, except the first named, very tender. The very large cones of some species, as *P. Lambertiana*, *Ayacahuite*, *Sabiniana* and *Coulteri*, are a conspicuous ornament. Most species are of vigorous growth when young, but the foreign species usually grow rather slowly and are therefore well suited for smaller gardens, especially *P. Koraiensis*, *Peuce*, *Bungeana*, *parviflora*; the American *P. aristata* and *flexilis* may also be recommended for this purpose. For planting rocky slopes *P. divaricata*, *rigida*, *Virginiana* and some western species are valuable; and if dwarf forms are desired *P. montana* is one of the best, thriving in more shaded positions and as undergrowth in open woods better than any other species.



1813. Staminate cone of Pinus rigida. (× 2.)



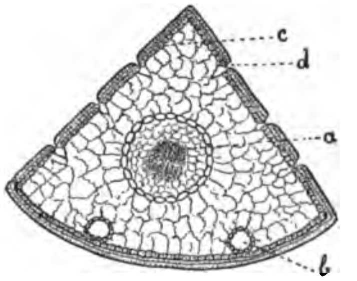
1814. Pistillate flowers (enlarged) of Austrian Pine; also a young pistillate cone natural size. *a*, front view of two ovules; *c*, side view.

The Pines are not very particular as to the soil, and in their native habitats they usually occupy the less fertile situations, as dry uplands and sandy plains. Some, as *P. rigida*, *Cubensis* and *Tæda*, can be grown both in dry and in swampy ground. *Pinus palustris* is very unhappily named, since it almost never grows in swamps. Pines are much used for the afforestation of barren sandy plains and dry rocky mountain slopes. For seaside planting *P. insignis*, *Pinaster*, *Halepensis* and also *P. rigida* are valuable.

Pines cannot be transplanted successfully when old on account of their long tap-roots, and only younger nursery-grown trees should be used for planting. As they cannot usually be taken up with a good ball of earth, it is well to immerse the roots in a loam puddle immediately after the trees are dug up. Pines are propagated by seeds sown in spring either in prepared beds or frames or in boxes or pans; the seeds should be covered only slightly with fine soil, but the larger ones about a quarter of an inch, and the young seedlings shaded and watered when necessary. Varieties and rarer kinds are grafted on their types or allied species, usually by veneer-grafting on potted stock in the greenhouse in winter. Cuttings even of the dwarf forms do not root readily; the easiest to root are young shoots with primary foliage, as they sometimes appear on older branches or on the trunk.

The Pines belong to the most important timber trees in their native countries; these are in eastern N. America *P. palustris*, *Strobus* and *echinata;* in the western states *P. Lambertiana*, *monticola* and *ponderosa;* in Europe *P. sylvestris* and *Laricio;* in eastern Asia *P. Thunbergi* and *densiflora*, and in the Himalayas *P. excelsa*. From the resinous secretions of many species, chiefly *P. palustris*, *Cubensis*, *Pinaster*, *Halepensis* and *longifolia*, turpentine, tar and pitch are obtained. An essential oil used medicinally is distilled from the lvs. and young shoots of several species. Edible seeds are produced by some species, in America by *P. edulis* and *cembroides;* in Europe by *P. Pinea* and *Cembra*, in E. India by *P. Gerardiana*. Mats similar to Cocoa mats are manufactured from the lvs. of *P. palustris* and Pine wool for stuffing mattresses is made from lvs. of European and American species.

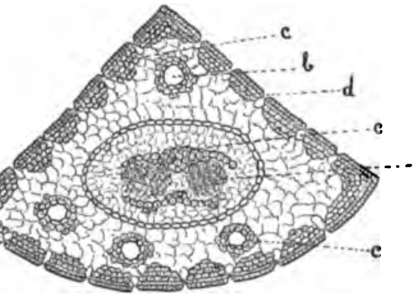
About 75 species are known, distributed through the northern hemisphere from the arctic circle to Mexico and the West Indies, N. Africa and the Malayan Archipelago; in the tropical and subtropical regions they are confined to the mountains. Resinous trees, rarely shrubs; winter-buds covered with imbricate scales: lvs. of 2 kinds; the primary lvs. are spirally arranged and as they appear on young seedling plants and occasionally on shoots from the old wood, are green and subulate, but commonly they are reduced to small scarious bracts bearing in their axils the acicular, semiterete or triangular secondary lvs. borne on an undeveloped branchlet in clusters from 2–5, rarely reduced to 1, surrounded at the base by sheaths of 8–12 bud-scales: fls. monœcious; the staminate ones axillary, clustered at the base of the young shoots, catkin-like, yellow, orange or scarlet, composed of spirally arranged numerous 2-celled anthers with the connective enlarged and scale-like at the apex (Fig. 1813); pistillate lateral or subterminal, greenish or purplish, consisting of numerous spirally arranged scales each in the axil of a small bract and bearing 2 ovules inside near the base (Fig. 1814): cone subglobose to cylindric, with woody scales closely appressed before maturity and tightly enclosing the seeds, which are usually furnished with a long thin wing, but in some species are wingless or short-winged; the apex of the scales is usually more or less thickened and the exposed part, which is usually rhombic in outline and termed apophysis, is often protracted into prominent bosses or knobs; the apophysis is terminated by the umbo, usually differing in color and ending mostly in a spine or prickle. In *P. Strobus* and the allied species the apophysis is flat and thin, and bears the spineless umbo at the upper end, while in most other Pines the apophysis is thickened and transversally keeled and bears the umbo in the middle. These differences belong to the most important characters in the grouping of the species: other valuable characters are furnished by the structure of the lvs., which contain either 1 or 2 fibro-vascular bundles and usually 2 or more resin-ducts, being either peripheral, i. e., situated beneath the epidermis; or parenchymatous, i. e., enclosed by the tissue of the leaf; or internal, i. e., near the fibro-vascular bundles; strengthening cells, i. e., cells with thickened walls, are mostly present beneath the epidermis and often surround the resin-ducts, sometimes also along the fibro-vascular bundles. (See Figs. 1815–1818). The number of the fibro-vascular bundles and the position of the resin-ducts can be readily seen with a common magnifying glass in thin cross-sections made with a sharp razor from the middle of the leaf and placed on a glass-plate.



1815. Pinus Strobus.

Leaf with a single fibro-vascular bundle (*a*), usually two peripheral resin-ducts (*b*); strengthening cells (*c*) only beneath the epidermis; stomata (*d*) only on the two inner sides.

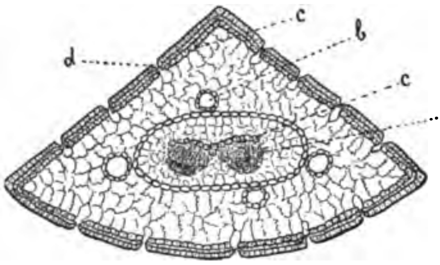
In the following enumeration the species are grouped according to Mayr's classification, with a few slight changes; his names of his sections, however, are omitted, since they are mostly not well chosen, and the sectional and subsectional names of Engelmann substituted as far as his groups could be brought in accordance with those of Mayr. To facilitate the determination of the cultivated species a key is given to determine plants without cones. Good illustrations are found in Sargent, Silva of N. America, vol. 11; Lambert, Description of the genus Pinus; Lawson, Pinetum Britannicum; Forbes, Pinetum Woburnense; Antoine, Die Coniferen. For the horticultural vars. see Beissner, Nadelholzkunde and the new edition by A. H. Kent of Veitch's Manual of the Coniferæ. Among other important works may be mentioned E. A. Carrière's Traité General des Coniféres, 2d edition, 1867; Heinrich Mayr's Die Waldungen von Nordamerika, 1890; Engler and Prantl's Die Natürlichen Pflanzenfamilien II Teil, 1. Abteilung, pages 70–74 (Leiferung 3 and 4); G. Engelmann's Revision of the Genus Pinus, in Transactions of the Academy of Science of St. Louis published in 1880; Maxwell T. Masters in Journal of the Linnean Society, volumes 22 (1886) and 27 (1889); Conifer Conference in Journal Royal Horticultural Society, volume 14 (1892).



1816. Pinus Coulteri.

Leaf with two fibro-vascular bundles (*a*); several parenchymatous resin-ducts (*b*); strengthening cells (*c*) around the resin-ducts, several layers beneath the epidermis and along the inner and the outer side of the fibro-vascular bundles; stomata (*d*) all around.

For a fuller account of the relative value of species of Pinus and their culture, see *Pine*.



1817. Pinus palustris.

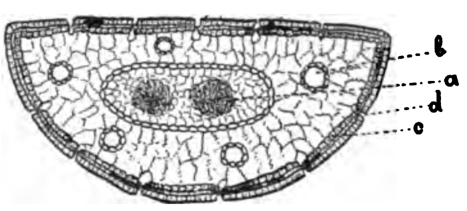
Leaf with two fibro-vascular bundles (*a*); several internal resin-ducts (*b*); one layer of strengthening cells (*c*) beneath the epidermis and on the inner side of the fibro-vascular bundles; stomata (*d*) all around.

INDEX.

alba, 3.
albo-terminata, 43.
argentea, 44.
aristata, 15.
attenuata, 26.
aurea, 43, 44.
australis, 23.
Austriaca, 36.
Ayacahuite, 6.
Balfouriana, 15.
Banksiana, 31.
Benthamiana, 20.
Bolanderi, 33.
brevifolia, 3.
Bungeana, 11.
Buonapartea, 6.
Boursieri, 33.
Calabrica, 36.
Canariensis, 24.
Carpatica, 45.
Cebennensis, 36.
Cembra, 10.
clausa, 32.
columnaris, 44.
compacta, 44.
contorta, 33.
Coulteri, 18.
Cubensis, 22.
densiflora, 43.
divaricata, 31.
Don-Pedrii, 6.
echinata, 29.
edulis, 13.
Elliotii, 22.
excelsa, 1.
fastigiata, 3, 44.
flexilis, 7.
Fremontiana, 14.
Grœzelieri, 4.
Halepensis, 41.
Hamiltoni, 37.
heterophylla, 22.
horizontalis, 36.
inops, 30.
insignis, 27.
Jeffreyi, 19.
Koraiensis, 9.
Lambertiana, 5.
Laricio, 36.
Lemoniana, 37.
Loudoniana, 6.
longifolia, 25.
macrocarpa, 18.
Mandshurica, 9.
maritima, 37.
Massoniana, 38, 42.
minor, 37.
mitis, 29.
monophylla, 14.
Monspeliensis, 36.
montana, 45.
Montereyensis, 27.
monticola, 4.
Mughus, 45.
muricata, 35.
Murrayana, 33.
nana, 3.
Nepalensis, 1.
nigra, 36.
nigricans, 36.
nivea, 3.
Oculus draconis, 38, 43.
Pallasiana, 36.
palustris, 23.
Parryana, 12.
parviflora, 8.
pendula, 20, 44.
Peuce, 2.
Pinaster, 37.
Pinea, 39.
Pithyusa, 41.
ponderosa, 20.
prostrata, 3.
pumila, 10, 44.
Pumilio, 45.
pungens, 34.
pygmæa, 3, 36.
pyramidalis, 3, 44.
Pyrenaica, 36 and suppl.
quadrifolia, 12.
radiata, 27.
resinosa, 40.
rigida, 28.
rostrata, 45.
rotundata, 45.
Roxburghi, 25.
Sabiniana, 17.
Salzmanni, 36.
scopulorum, 20.
Sibirica, 10.
Sinensis, 42.
Strobus, 3.
sylvestris, 44.
Tæda, 21.
Thunbergi, 38.
Torreyana, 16.
tuberculata, 26.
umbraculifera, 3.
uncinata, 45.
variegata, 38, 43.
Virginiana, 30.
zebrina, 1.

Key for Determining Pines Without Cones (compare Figs. 1815–1818).

A. *Number of lvs. 5, only occasionally 3 or 4.*
B. *Sheaths deciduous: fibro-vascular bundle 1.*
C. *Edges of lvs. serrulate.*
D. *Length of lvs. 1½–8 in.*
E. *Branchlets glabrous or nearly so.*
F. *The lvs. 6–8 in. long: branchlets glaucous.* 1. **excelsa**
FF. *The lvs. 3–5 in. long: branchlets not glaucous.*
G. *Tree a rather dense pyramid* .... 2. **Peuce**
GG. *Tree an open pyramid*.............. 3. **Strobus**
EE. *Branchlets densely brownish tomentose* ..10. **Cembra**
EEE. *Branchlets pubescent or puberulous.*
F. *Needles slender, somewhat pendulous, 4–6 in. long*... 6. **Ayacahuite**
FF. *Needles stiff, 1½–4 in. long.*



1818. Pinus echinata.

Leaf with two fibro-vascular bundles (*a*) and several parenchymatous resin-ducts (*b*); only one layer of strengthening cells (*c*) beneath the epidermis; stomata (*d*) all around.

G. *Back of lvs. with fine white lines*... 5. **Lambertiana**
GG. *Back of lvs. usually not lined.*
H. *Color of lvs. bluish or dark green* .... 4. **monticola**
HH. *Color of lvs. bright green*.... 9. **Koraiensis**
DD. *Length of lvs. ¾–1½ in.: lvs. usually twisted, forming brush-like tufts at the end of the branchlets* .... 8. **parviflora**
CC. *Edges of lvs. entire.*
D. *Lvs. 1½–3 in. long*...... 7. **flexilis**
DD. *Lvs. 1–1½ in. long*......15. **Balfouriana**
BB. *Sheaths persistent: fibro-vascular bundles 2: lvs. 8–12 in. long, rigid* ....16. **Torreyana**
AA. *Number of lvs. 3, or 4 or 1, only occasionally 2 or 5.*
B. *Usually solitary, sometimes in 2's*.......................14. **monophylla**
BB. *Usually 4, sometimes 3 or 5*..12. **Parryana**
BBB. *Usually 3, occasionally 2.*
C. *Fibro-vascular bundle 1: sheaths deciduous.*
D. *Margin of lvs. entire: lvs. ¾–1½ in. long*.........13. **edulis**
DD. *Margin of lvs. serrulate: lvs. 2–4 in. long* ....11. **Bungeana**
CC. *Fibro-vascular bundles 2: sheaths persistent.*
D. *Branchlets glaucous: lvs. bluish or grayish green.* (See also No. 21.)
E. *Habit of lvs. slender, drooping*.............17. **Sabiniana**
EE. *Habit of lvs. straight, stiff.*
F. *Buds very resinous: lvs. 6–12 in. long, dark bluish green*...18. **Coulteri**
FF. *Buds not or little resinous: lvs. 5–8 in. long, pale bluish green*...............19. **Jeffreyi**
DD. *Branchlets not glaucous: lvs. dark yellow or bright green.*
E. *Habit of lvs. slender, drooping.*
F. *Resin-ducts internal*.................23. **palustris**
FF. *Resin-ducts parenchymatous: buds brown*..............24. **Canariensis**
FFF. *Resin-ducts peripheral: buds bright chestnut-brown* .....25. **longifolia**
EE. *Habit of lvs. stiff.*
F. *Length of lvs. 6–12 in.*

G. *Buds cylindric, with spreading scales little or not resinous: lvs. 8–12 in. long, dark green, in 2's and 3's*...............22. **Cubensis**
GG. *Buds oblong-ovate, resinous: lvs. 6–9 in. long, light or slightly bluish green*.............21. **Tæda**
GGG. *Buds ovate, acuminate, resinous: lvs. 5–11 in. long, dark yellowish green*...20. **ponderosa**
FF. *Length of lvs. 3–7 in.* (See also No. 29.)
G. *Character of lvs. slender.*
H. *Foliage pale yellowish or bluish green: buds oblong-ovate, dark brown*....26. **tuberculata**
HH. *Foliage bright green: buds ovate, bright chestnut-brown*.27. **radiata**
GG. *Character of lvs. stout.*
H. *Form of buds thick, ovate, acute or acuminate*...........20. **ponderosa, var. scopulorum**
HH. *Form of buds oblong-ovate*......28. **rigida**
AAA. *Number of lvs. 2.*
B. *Branchlets glaucous.*
C. *Buds very resinous*........30. **Virginiana**
CC. *Buds not or little resinous.*
D. *Hue of lvs. dark bluish green*..................29. **echinata**
DD. *Hue of lvs. bright green*..43. **densiflora**
BB. *Branchlets not glaucous.*
C. *Length of lvs. 1–3½ in.*
D. *Branchlets brown or orange: resin-ducts parenchymatous.*
E. *Character of lvs. slender: branchlets brown*.32. **clausa**
EE. *Character of lvs. stout, twisted: branchlets orange or orange-brown.*
F. *Lvs. 1–3½ in. long.*
G. *Resin-ducts 1 or 2*.33. **contorta**
GG. *Resin-ducts 2–5*...34. **pungens**
FF. *Lvs. ½–1 in. long*...31. **divaricata**
DD. *Branchlets dull greenish yellow or greenish brown: resin-ducts peripheral.*
E. *Character of lvs. slender: buds not resinous*..................41 **Halepensis**
EE. *Character of lvs. stout: buds coated with resin.*
F. *Generally a tree*.....44. **sylvestris**
FF. *Generally a shrub*...45. **montana**
CC. *Length of lvs. 3–9 in.*
D. *Color of buds whitish or grayish white*..........38. **Thunbergi**
DD. *Color of buds brown.* (See also No. 41.)
E. *Scales of the oblong buds with reflexed tips, chestnut-brown.*
F. *Habit of lvs. very slender and thin*...42. **Massoniana**
FF. *Habit of lvs. stiff and rigid.*
G. *Buds resinous*....35. **muricata**
GG. *Buds not resinous.*
H. *Resin-ducts parenchymatous*...37. **Pinaster**
HH. *Resin-ducts peripheral*........39. **Pinea**
EE. *Scales of the thick ovate-acuminate buds with the tips not reflexed, light brown, resinous.*
F. *Foliage lustrous, resin-ducts peripheral*................38. **resinosa**
FF. *Foliage dull: resin-ducts parenchymatous*................36. **Laricio**

Key Based on Cones and Seeds.

A. *Cone-scales thin at the apex, with a marginal obtuse umbo: number of lvs. 5: sheaths deciduous: fibro-vascular bundle 1: wood soft and light..* STROBUS.
B. *Wings longer than seed: cones long and slender: resin-ducts of lvs. peripheral. Eustrobi.*
C. *Scales with broad, rounded apex.*
D. *Lvs. slender: branchlets usually glabrous*....... 1. **excelsa**
2. **Peuce**
3. **Strobus**
DD. *Lvs. stout: branchlets puberulous or pubescent.* 4. **monticola**
5. **Lambertiana**
CC. *Scales with elongated and tapering, at last recurved apex*..................... 6. **Ayacahuite**
BB. *Wings shorter than seeds or wanting: cones more or less ovate, with thickened scales. Cembræ.*
C. *Margin of lvs. entire: branchlets glabrous, light brown*..................... 7. **flexilis**
CC. *Margin of lvs. serrulate: branchlets pubescent.*
D. *Seeds with narrow wing: resin-ducts peripheral*.. 8. **parviflora**
DD. *Seeds wingless: resin-ducts parenchymatous*.. 9. **Koraiensis**
10. **Cembra**
AA. *Cone-scales more or less thickened at the apex, with the often spiny umbo in the middle of the transversely ridged apophysis.* PINASTER.
B. *Sheaths caducous or curling back and tardily deciduous: fibro-vascular bundle 1: resin-ducts peripheral.*
C. *Seeds short-winged: number of lvs. 1–4, only occasionally 5.*
D. *Margin of lvs. serrulate, 3; sheaths caducous. Gerardianæ*............11. **Bungeana**
DD. *Margin of lvs. entire; sheaths curling back and falling off end of the first year. Cembroides.*
E. *Number of lvs. 3–5*....12. **Parryana**
EE. *Number of lvs. 1–3*....13. **edulis**
14. **monophylla**
CC. *Seeds with long wing: number of lvs. 5: margin entire. Balfourianæ*.............15. **Balfouriana**
BB. *Sheaths persistent: fibro-vascular bundles 2: margin of lvs. serrulate.*

c. *Number of lvs. 5: resin-ducts parenchymatous. Pseudostrobi*..............16. **Torreyana**
cc. *Number of lvs. 3, occasionally 4–5: resin-ducts usually parenchymatous. Tædæ.*
d. *Branchlets glaucous: color of lvs. bluish or grayish green.*
e. *Lvs. slender, drooping*.17. **Sabiniana**
ee. *Lvs. stout, 6–12 in. long: seeds long-winged*....18. **Coulteri**
19. **Jeffreyi**
dd. *Branchlets not glaucous: color of lvs. dark yellowish or bright green.*
e. *Length of lvs. 5–12 in.: lvs. stout* ....20. **ponderosa**
21. **Tæda**
22. **Cubensis**
ee. *Length of lvs. 8–18 in.: lvs. slender, drooping*.23. **palustris**
24. **Canariensis**
25. **longifolia**
eee. *Length of lvs. 3–7 in.: lvs. stout.* (See also No. 20 var.)
f. *Cones very oblique, 3½–6 in. long: length of lvs. usually 4–6 in*..................26. **tuberculata**
27. **radiata**
ff. *Cones not oblique, 2–4 in. long: length of lvs. usually 3–4 in*..28. **rigida**
ccc. *Number of lvs. 2.*
d. *Resin-ducts parenchymatous: cones mostly between the whorls. Lariciones*..............29. **echinata**
e. *Branchlets glaucous* ..30. **Virginiana**
ee. *Branchlets not glaucous.*
f. *Lvs. 1–3½ in. long.*
g. *Cones not prickly*..31. **divaricata**
gg. *Cones prickly*.....32. **clausa**
33. **contorta**
34. **pungens**
ff. *Lvs. 3½–7 in. long.*
g. *Winter-buds brown*.35. **muricata**
36. **Laricio**
37. **Pinaster**
gg. *Winter-buds grayish white or silvery white, oblong, not resinous, only tips of scales often light brown*.......38. **Thunbergi**
dd. *Resin-ducts peripheral: cones usually appearing at the whorls. Sylvestres.*
e. *Length of lvs. 2½–8 in.*
f. *Seeds short-winged, ¾ in. long*..........39. **Pinea**
ff. *Seeds long-winged.*
g. *Branchlets not glaucous* ....40. **resinosa**
41. **Halepensis**
42. **Massoniana**
gg. *Branchlets glaucous*..............43. **densiflora**
ee. *Length of lvs. ¾–2½ in*.44. **sylvestris**
45. **montana**

I. STROBUS.

1. *Eustrobi.*

1. **excélsa**, Wall. (*P. Nepalénsis*, Chambr.). Attains 150 ft., with spreading and slightly ascending branches forming a broad open pyramid: branchlets greenish, glabrous, glaucous: winter-buds cylindric-obovate, acute: lvs. slender, flaccid, drooping, grayish or bluish green, 6–8 in. long: cones cylindric on 1–2 in. long stalks, 6–10 in. long: seed brown, 4 lines long. Himal. Gn. 31, p. 195. A.G. 19:149.—Handsome tree, of somewhat loose habit, with graceful pendulous foliage, hardy as far north as Mass. in sheltered positions. Var. **zebrina**, Bailly, has the lvs. with a whitish zone near the tip.

1819. Pinus Strobus. (× ½.)

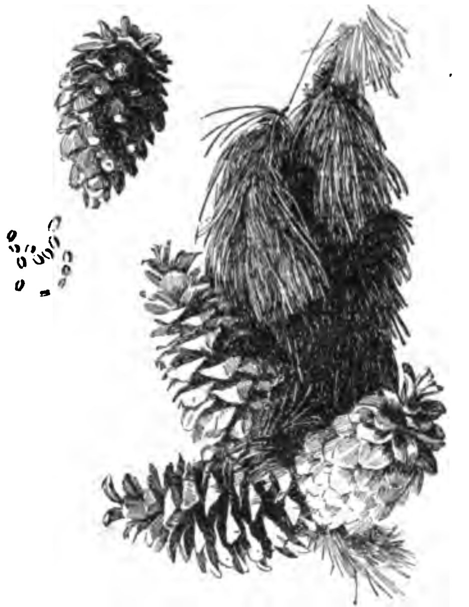
2. **Peùce**, Griseb. (*P. excélsa*, var. *Peùce*, Griseb.). Attains 50 ft., with ascending short branches forming a narrow dense pyramid: branchlets greenish, glabrous, not glaucous: winter-buds ovate: lvs. straight, bluish green, 3–4 in. long: cones short-stalked, cylindric, 3½–6 in. long, with obovate scales: seed 4 lines long. S. E. Eu.—An ornamental hardy Pine of dense, regular habit and slow growth; forms a narrower and denser pyramid than No. 3.

3. **Stròbus**, Linn. WHITE PINE. Figs. 1815, 1819, 1820. Attains 100, occasionally 150 ft., with horizontal branches in regular whorls forming a symmetrical open pyramid. In old age the head is usually broad and open and often very picturesque. Branchlets greenish or light greenish brown, glabrous or slightly puberulous: winter-buds ovate, acuminate: lvs. soft, bluish green, 2–4 in. long (or 3½–5): cones on stalks ½–1 in. long, cylindric, slender, often curved, 2–4 in. long, with oblong-obovate scales: seed red-brown, mottled with black, 3 lines long. Newfoundland to Manitoba, north to Ga., Ill. and Iowa. S.S. 11:538, 539. A.G. 12:645; 13:1. Gn. 30, p. 404.—Very valuable ornamental hardy Pine of rapid growth, symmetrical when young, picturesque in old age: no tree is better adapted to break up the monotonous sky-line of plantations in northern parks. There are a number of garden forms occasionally cultivated. Var. **álba**, Loud. (var. *nívea*, Carr.). Low form of irregular habit, with almost silvery white foliage. Var. **brevifòlia**, Loud. (var. *nàna*, Knight. Var. *pygmæa*, Hort.). Dwarf, compact, round bush, with short lvs. Var. **fastigiàta**, Beissn. (var. *pyramidàlis*, Hort.). With ascending branches, of narrow pyramidal or columnar habit. Var. **prostràta**, Arb. Kew. Dwarf, procumbent form, diffuse and trailing on the ground. Var. **umbraculífera**, Knight. Dwarf, flat-topped bush, with short lvs. R.H. 1869, p. 38. There are also forms with variegated and with yellow foliage.

4. **montícola**, Don. MOUNTAIN WHITE PINE. Tree, to 100 or occasionally 150 ft., with slender, spreading, somewhat pendulous branches forming a narrow open pyramid: branchlets puberulous, yellowish or reddish brown: winter-buds ovate, acute: lvs. stiff, bluish green and glaucous, 1½–4 in. long, with few inconspicuous or no lines on the back: cones short-peduncled, cylindric, slender, slightly curved, 5–11 in. long, yellow-

1820. Pinus Strobus (× ½).

ish brown; scales pointed by the slightly thickened umbo: seed red-brown, mottled with black, 1/8 in. long. Brit. Col. to Idaho and Calif. S.S. 11:540, 541. G.F. 5:5, 7. R.H. 1869, p. 126 (as *P. Græzelieri*).—Similar to *P. Strobus*, but forming a somewhat narrower, more slender pyramid; hardy as far north as Mass.



1821. Pinus flexilis (× 1/4).

5. **Lambertiàna,** Dougl. SUGAR PINE. Fig. 1823. Tree, to 200 or 220 ft., with spreading somewhat pendulous branches forming a narrow open pyramid; old trees usually with flat-topped wide-spreading open head: branchlets brown, pubescent: winter-buds oblong-obovate, apiculate: lvs. stout, sharply pointed, dark bluish green, 3–4 in. long, with conspicuous white lines on the back: cones on peduncles 2–3½-in. long, cylindric, often slightly curved, light brown, lustrous, 10–20 in. long: seed about ½ in. long, dark brown or nearly black. Ore. to Mex. S.S. 11:542, 543. Gn. 31, p. 152, 153. G.C. II. 23:11; III. 1:769.—One of the tallest trees of the Pacific coast; in the eastern states it is hardy as far north as Mass., but grows only slowly; has handsome dark foliage.

6. **Ayacahùite,** Ehrenb. (*P. Buonapàrtea*, Rœzl. *P. Don-Pedrii*, Rœzl. *P. Loudoniàna*, Gord.). Tree, to 100 ft., with spreading, slender branches: branchlets yellowish brown, finely pubescent: lvs. slender and somewhat pendulous, bluish green, 4–6 in. long: cones short-stalked, cylindric conical, gradually narrowed toward the apex, often slightly curved, brownish yellow, 9–15 in. long: seeds about ½ in. long, gray-brown, mottled dark brown. North Mex. G.C. II. 18:493; III. 20:751, 753. Gn. 25, pp. 192, 193.—Handsome tree, somewhat resembling the White Pine, but foliage more slender, especially ornamental with its large cones. Not hardy north.

2. *Cembræ.*

7. **fléxilis,** James. LIMBER PINE. Fig. 1821. Tree, to 50, occasionally to 80 ft., with stout horizontal branches forming a narrow open pyramid, in old age with low, broad, round-topped head: winter-buds broadly ovate, slender-pointed: lvs. rigid, acute, dark green, 1½–3 in. long: cones ovate to cylindric-ovate, light brown, 3–6, rarely 10 in. long; scales rounded at the apex, tipped with an obtuse, dark umbo, the lower ones elongated and reflexed: seeds dark brown, mottled with black, 1/8–½ in. long, with narrow wing. Alberta to Calif. and New Mex. S.S. 11:546, 547. G.F. 10:165.—Hardy Pine of slow growth; seems to be best adapted for ornamental planting on rocky slopes.

8. **parviflòra,** Sieb. & Zucc. Tree, to 80 ft., of dense, pyramidal habit, with slender, horizontal branches: branchlets light greenish brown, puberulous: lvs. crowded, rather stiff, usually twisted, forming brush-like tufts at the end of the branchlets, bluish green, ¾–1½ in. long: cones ovate or oblong-ovate, almost sessile, reddish brown, 2–3 in. long: seeds dark brown, hardly ½ in. long. Japan. S.Z. 2:115.—Hardy and very ornamental Pine, bearing numerous decorative cones when older. Cultivated plants are often grafted and assume a more irregular habit. In Japan it is often cultivated in pots and dwarfed. A.G. 14:212.

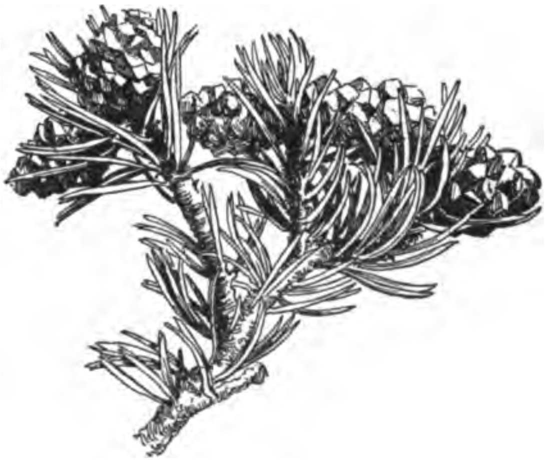
9. **Koraiénsis,** Sieb. & Zucc. (*P. Mandshùrica*, Rupr.). Pyramidal tree, to 100 ft.: branchlets with yellowish brown pubescence: winter-buds oblong-ovate, acuminate, dark chestnut-brown: lvs. straight, dark green and glossy on the back, bluish white on the inner sides, 2½–4 in. long: cones almost sessile, conic-ovate, yellowish brown, 4–6 in. long; scales rhombic-obovate, with recurved obtuse apex: seed over ½ in. long, brown, sharply edged. Japan, Corea. S.Z. 2:116. Gng. 6:1.—In cultivation of slow growth, forming a rather dense, broad pyramid, with handsome foliage. One of the best hardy Pines for smaller gardens.

10. **Cémbra,** Linn. SWISS STONE PINE. Tree, to 70 or occasionally 120 ft., with spreading usually short branches forming a narrow, dense pyramid, in old age often with very picturesque broad, open, round-topped head: branchlets coated with dense yellowish brown tomentum: winter-buds globose-ovate, long acuminate: lvs. straight, dark green on back, bluish white inside, 2–3½ in. long: cones short-peduncled, ovate, obtuse, light brown, 2½–3½ in. long; scales broadly ovate, rounded at apex, apophysis much broader than high: seed ½ in. long. M. European, Alps to N. Russia and N. Asia. G.C. II. 17:80, 81; III. 24:459. Gn. 19, p. 369; 28, p. 175, 182. Gt. 45, p. 205.—Handsome hardy Pine of slow growth and symmetrical habit when young. Var. **Sibírica,** Loud., has shorter lvs. and longer cones, and is of narrower habit and more vigorous growth. Var. **pùmila,** Pall. See *P. pumila* in suppl. list.

II. PINASTER.

3. *Gerardianæ.*

11. **Bungeàna,** Zucc. LACE BARK PINE. WHITE BARK PINE. Tree, to 80 or 100 ft., with long and slender branches: bark flaky, light gray: young branches grayish green, glabrous: lvs. rigid, acute, light green, 2–4 in. long: cones almost sessile, conic-ovate, light yellowish brown, 2–3 in. long; apophysis much broader than high, ridged, with a triangular pointed and recurved umbo: seed dark brown, with narrow wing, 1/8–½ in. long. N. China. G.C. II. 18:9.—Hardy slow-growing tree of bushy habit in cultivation and with rather sparse light green foliage.



1822. Pinus edulis (× 1/3).

4. *Cembroides.*

12. **Parryàna,** Engelm. (*P. quadrifòlia,* Sudw.). NUT PINE. PINNON. Tree, to 40 ft., with stout, spreading branches, forming a regular pyramid but usually round-topped and irregular in old age: branchlets puberulous, light grayish brown: lvs. 3–5, usually 4, rigid, incurved, pale glaucous green, 1½–1¾ in. long: cone subglobose, 1½–2 in. broad, chestnut-brown, lustrous; apophysis thick, pyramidal, conspicuously keeled; umbo with minute recurved prickle: seed about ½ in. long. Calif. S.S. 11:549.—Not hardy north.

13. **édulis,** Engelm. NUT PINE. Fig. 1822. Small tree, 10–20 or occasionally to 40 ft., with horizontal branches, bushy when young, with low, round-topped head in old age: branchlets light yellowish brown, puberulous at first: lvs. 2–3, rigid, dark green, ¾–1½ in. long: cones almost sessile, broadly ovate, greenish yellow, lustrous, about 1½ in. long; apophysis pyramidal, strongly keeled; umbo with minute recurved tip: seed ½ in. long, with narrow wing remaining attached to the scale. Colo. to North Mex. and Tex. S.S. 11:552.—Hardy as far north as Mass., forming a slow-growing and compact bush. The seeds are an important article of food among the Indians.

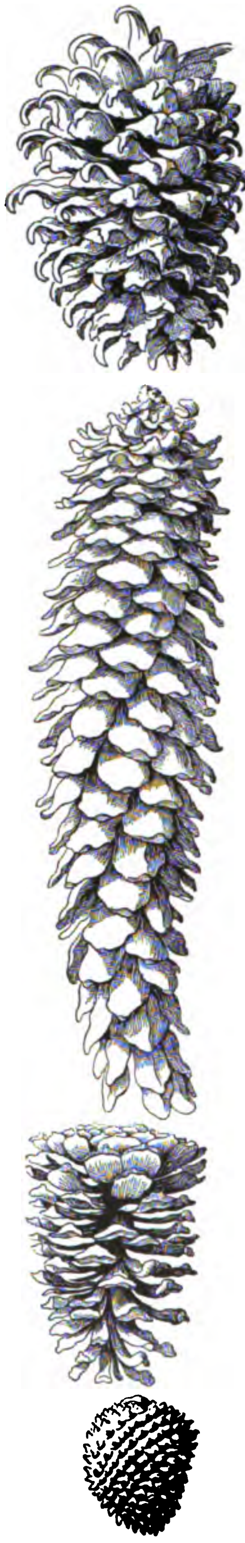
14. **monophýlla,** Torr. & Frem. (*P. Fremontiàna,* Endl.). Tree, 15–20, occasionally to 50 ft., similar to the preceding: branchlets light orange, glabrous: lvs. usually solitary, sometimes 2, terete, rigid, spinescent, glaucous green, ¾–1½ in. long; cones broadly ovate, light brown, 1½–2 in. long; apophysis depressed-pyramidal, ridged, the flattened umbo with a minute incurved tip: seed ½ in. long. Calif. to Colo. and Ariz. S.S. 11: 551. G.C. II. 20: 44: 26:137.—Of slow growth, hardy as far north as Mass. The solitary leaf has been believed to consist of two connate ones, but this is certainly not the case, as the one fibro-vascular bundle plainly shows.

5. *Balfourianæ.*

15. **Balfouriàna,** Jeffrey. FOXTAIL PINE. Tree, to 40, occasionally 90 ft., narrow pyramidal when young, irregular and open in old age: branchlets dark brown, puberulous at first: lvs. crowded, incurved and pressed against the branches, rigid, acute, dark green on the back, white inside, 1–1½ in. long, remaining for 10 or 12 years on the branches; cones pendulous, subcylindric, dark purplish brown, 3½–5 in. long; apophysis flattened, the concave oblong umbo with minute incurved prickle: seed ⅓ in. long, Calif. S.S. 11:553.—Not hardy north. Var. **aristàta,** Engelm. (*P. aristàta,* Engelm.). Bushy tree, occasionally to 50 ft., sometimes a semi-prostrate shrub: branchlets of lighter color and almost glabrous: lvs. with less conspicuous white lines inside: cones cylindric-ovate, 3–3½ in. long; apophysis elevated; umbo with a slender incurved spine to ¼ in. long. Calif. to Utah and Ariz. S.S. 11:554. G.C. III. 20:719.—Hardy as far north as Mass.; in cultivation usually a handsome low, bushy shrub of distinct habit: lvs. often sprinkled with resinous dots.

6. *Pseudostrobi.*

16. **Torreyàna,** Parry. SOLEDAD PINE. Tree, to 40 or occasionally to 60 ft., with spreading and sometimes ascending branches: branchlets greenish or purplish, bloomy, glabrous: lvs. rigid, dark green, 8–13 in. long: cones broadly ovate, 4–6 in. long, chocolate-brown; apophysis low-pyramidal, umbo elongated and reflexed with short spiny tip: seeds ¾ in. long, short-winged. S. Calif. S.S. 11:557, 558. —Rarely cult.; not hardy north.



1823. Cones of Pines.
Beginning at the top: *P. Coulteri. Lambertiana, palustris, radiata.* (× 1·5.)

7. *Tædæ.*

17. **Sabinianà,** Dougl. DIGGER PINE. BULL PINE. Tree, to 50 or occasionally 80 ft., usually divided into several stems, with short crooked branches, the lower ones pendent, the upper ones ascending, forming a round-topped head: lvs. slender, flexible, pale bluish green, 8–12 in. long: cones pendent on about 2-in. long stalks, oblong-ovate, light red-brown, 6–10 in. long; apophysis pyramidal, sharply keeled, flattened at the straight or incurved apex, the lower scales with much recurved apex: seeds ¾ in. long, short-winged. Calif. S.S. 11:569. G.C. III. 4:43; 5:45. F.S. 9:964.—Not hardy north. Distinct Pine of loose habit and with sparse pale foliage. The seeds are edible.

18. **Còulteri,** Don (*P. macrocárpa,* Lindl.). PITCH PINE. Fig. 1823. Tree, to 80 ft., with stout branches, pendulous below and ascending above, forming a loose pyramidal head: winter-buds oblong-ovate, resinous: lvs. stout, acuminate, dark bluish green, 6–12 in. long: cones short-stalked, pendent, cylindric-ovate, yellowish brown, 9–14 in. long; apophysis elongated-pyramidal, narrowed into the compressed spiny-tipped straight or incurved umbo: seed ½ in. long. Calif. S.S. 11:571, 572. G.C. II. 23:409, 413; III. 4:765.—Not hardy north. Old trees are often very picturesque and the large cones are conspicuous and ornamental.

19. **Jéffreyi,** Murray (*P. ponderòsa,* var. *Jeffreyi,* Vasey). JEFFREY'S PINE. Tree, to 120 or occasionally to 180 ft., with short spreading or often pendulous branches, the uppermost ascending, forming an open pyramidal and sometimes narrow spire-like head: young branches fragrant when broken: winter-buds oblong-ovate, not resinous: lvs. stout, acute, pale bluish green, 5–8 in. long: cones conic-ovate, light brown, 6–12 in. long; apophysis depressed, keeled; umbo elongated into a slender recurved spine: seed about ½ in. long. Ore. to Calif. S. S. 11:562, 563. G. C. II. 22:813; III. 5:361, 369. G.F. 5:185.—Distinct and ornamental Pine of symmetrical habit when young, hardy as far north as Mass. Among the hardier species this Pine has the longest lvs.

20. **ponderòsa,** Dougl. (*P. Benthamiàna,* Hartw.). YELLOW PINE. BULL PINE. Figs. 1807–9. Tree, to 150, occasionally to 230 ft., with stout spreading and often pendulous branches usually ascending at the ends and forming a narrow, spire-like head: branchlets reddish brown, fragrant when broken: winter-buds oblong-ovate or ovate, resinous: lvs. acute, dark green, 5–11 in. long: cones almost sessile, often in clusters, ovate-oblong, light reddish or yellowish brown and lustrous, 3–6 in. long; apophysis depressed-pyramidal or flattened, with a broadly triangular umbo terminated by a stout, usually recurved prickle; lower scales with more elongated apex: seed ¼ in. long. Brit. Col. to Mex., east to Neb. and Tex. S.S. 11:560, 561. G. F. 8:395. G.C. III. 8: 557, 561, 569.—One of the tallest and most important Pines of the western states. Hardy as far north as New York, and in sheltered positions to Mass. Var. **péndula,** H.W. Sarg., has drooping branches. Var. **scopulòrum,** Engelm. (*P. scopulòrum,* Lemm.), is a geographical var., smaller in

every part: usually to 75 ft. high: lvs. 5–7 in. long, sometimes in 2's: cones smaller, ovate. S. Dakota to N. Mex. and Tex. S.S. 11:564. G.C. II. 9:797.—Somewhat hardier than the type.

1824. Pinus rigida (× ⅓).

21. **Tæda,** Linn. LOBLOLLY PINE. OLD FIELD PINE. FRANKINCENSE PINE. Tree, to 100, occasionally to 170 ft., with spreading branches, the upper ascending, forming a compact, round-topped head: branchlets yellowish brown, sometimes slightly bloomy: winter-buds oblong, resinous: lvs. slender but stiff, acute, bright green, 6–9 in. long: cones sessile, spreading, conic-oblong, light reddish brown, 3–5 in. long; apophysis flattened or depressed-pyramidal; umbo small, with short, triangular, recurved spine, lower scales not elongated: seed ⅛ in. long. Del. to Fla. and Tex. S.S. 11:577, 578.—Not hardy north and rarely cult. for ornament.

22. **Cubénsis,** Griseb. (*P. heterophýlla*, Sudw. *P. Ellióttii*, Engelm.). SLASH PINE. SWAMP PINE. Tree, to 100 or 120 ft., with horizontally spreading branches forming a round-topped broad and compact head: branchlets orange-brown: winter-buds cylindric, light brown: lvs. dark green and lustrous, acute, in 3's and 2's, 8–12 in. long, with internal resin-ducts: cones short-peduncled, conic-oblong, dark brown and glossy, 3–6½ in. long; apophysis flattened, keeled; umbo small, with minute recurved prickles: seed ⅙–¼ in. long. Ga. to Fla., near the coast. S.S. 11:591, 592.—Handsome Pine, with compact broad head, hardy only south.

23. **palústris,** Mill. (*P. austràlis*, Michx.). LONG-LEAFED PINE. SOUTHERN PINE. Fig. 1823. Tree, to 100 or 120 ft. with ascending branches forming an oblong open head: branchlets orange-brown; winter-buds whitish, oblong: lvs. crowded, forming tufts at the end of branchlets, dark green, 8–18 in. long, with internal resin-ducts: cones almost sessile, cylindric, dull brown, 6–10 in. long; apophysis flattened; umbo dark brown, with triangular, reflexed short spines: seed almost ½ in. long. Va. and Fla., to Miss. along the coast. S.S. 11:589, 590. G.F. 10:115.—Very important timber tree, but rarely planted for ornament; hardy only south Branches are imported in great quantities into the northern cities in midwinter and used for decorations on account of their large, handsome foliage.

24. **Canariénsis,** C. Sm. Tree, to 80 ft., with slender branches forming a broad, round-topped head: branchlets yellowish: lvs. slender, spreading and pendulous, light green and lustrous, 9–12 in. long, with parenchymatous resin-ducts: cones cylindric-ovate, 4–8 in. long; apophysis low-pyramidal, irregularly 4-sided, light brown and glossy, with obtuse umbo: seed ½ in. long. Canary Isl. G.C. III. 3:721.—Handsome Pine, cult. in Calif. and in colder regions, sometimes in the greenhouse.

25. **longifòlia,** Lamb. (*P. Róxburghi*, Sarg.). Tree, to 100 ft. or more, with round-topped symmetrical head: branchlets light yellow brown: winter-buds oblong, light chestnut-brown, not resinous: lvs. slender, pendulous, light green, 8–12 in. long, with peripheral resin-ducts: cones short-stalked, conic-ovate, 4–7 in. long; apophysis elongated-pyramidal, compressed, more or less recurved; umbo obtuse: seed ¾–1 in. long. Himal.—Important forest tree in its native country. Not hardy north, but cult. in Calif. Very decorative as a young plant, with its long drooping light green foliage.

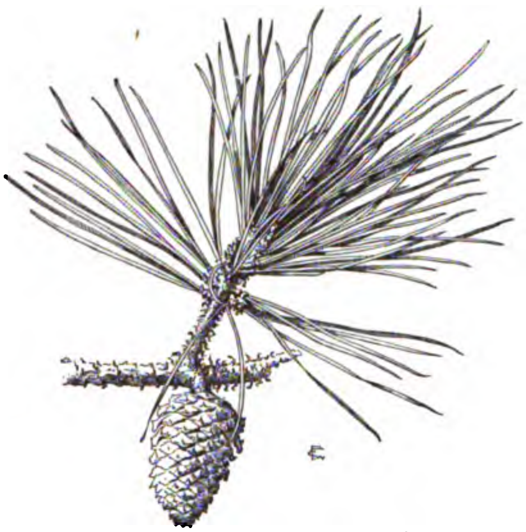
26. **tuberculàta,** Gord. (*P. attenuàta*, Lemm.). KNOBCONE PINE. Tree, usually 20, occasionally to 100 ft., with slender horizontal branches ascending at the ends, forming a broad pyramid, with open, round-topped head in old age: bark thin, scaly: young branches slender, dark orange-brown: winter-buds oblong-ovate, dark brown: lvs. slender, acuminate, pale yellowish or bluish green, 3–7, usually 4–5 in. long: cones short-stalked, usually in clusters, elongated-conical, 3½–6 in. long, upper scales with pyramidal apex; umbo prominent, sharply pointed and recurved, lower scales with depressed apex and small prickly umbo: seed ¼ in. long. Ore. to Calif. S.S. 11:575, 576. G.C. II. 24:784, 785. F.S. 5, p. 517c.—Of little ornamental value and not hardy north. Usually a bushy tree with sparse dull foliage.

27. **radiàta,** Gord. (*P. insignis*, Dougl. *P. Montereyénsis*, Hort.). MONTEREY PINE. Fig. 1823. Tree, to 80 or 100 ft., with stout, spreading branches forming an irregular open, round-topped head: bark thick, furrowed: branchlets brown: buds ovate, bright chestnut-brown: lvs. acute, bright green, 4–6 in. long: cones short-stalked, conic-ovate, upper scales with elevated, rounded, almost hemispherical and obscurely keeled apex; umbo small, with minute straight or recurved prickle, lower scales with almost flattened apex: seed black, ¼ in. long. S. Calif. S.S. 11:573, 574. F.S. 6, p. 44. G.C. III. 9:336, 341. Gn. 36, p. 47; 49, p. 312.—Handsome species with bright green foliage and of rapid growth and bushy habit when young; valuable for seaside planting. Not hardy north.

28. **rigida,** Mill. PITCH PINE. Figs. 1813, 1824–1827. Tree, to 80 ft., with horizontally spreading branches forming an open, irregular pyramid: branchlets light brown: winter-buds ovate or ovate-oblong, chestnut-brown: lvs. stiff and spreading, acuminate, dark green, 2–5 in. long: cones almost sessile, often in clusters, ovate, light brown, 2–4 in. long; apophysis little elevated; umbo triangular, ending in a slender, recurved prickle: seed dark brown, ¼ in. long. New Brunswick to Ga., west to Ontario and Ky. S.S. 11:579. G.F. 4:402; 10:195. Gn. 31, p. 128, 132. M.D.G. 1896:301.—

1825. Pinus rigida, with young cones (× ½).

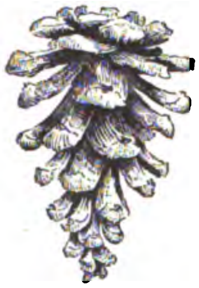
Hardy Pine of rapid growth when young and easily raised from seed; grows on dry and sterile soil. As an ornamental plant it may be used on dry and rocky slopes, where it becomes often very picturesque when older. It sprouts readily from stumps if cut down or destroyed by fire.


1826. Pinus rigida, recent cone (× ½).

8. *Lariciones.*

29. **echinàta,** Mill. (*P. mìtis*, Michx.). SPRUCE PINE. YELLOW PINE. Tree, to 100 or 120 ft., with slender often pendulous branches in regular whorls: winter-buds oblong-ovate, brown: lvs. slender, acute, dark bluish green, sometimes in 3's, 3–5 in. long: cones short-stalked or almost sessile, conic-oblong, dull brown, 1½–2 in. long; apophysis flattened; umbo little elevated, with short straight or curved prickle: seeds one-fifth to ¼ in. long. N. Y. to Fla., west to Ill. and Tex. S.S. 11:587.—Handsome tree, with broad, oval head, hardy as far north as Mass.

30. **Virginiàna,** Mill. (*P. ìnops*, Ait.). SCRUB PINE. JERSEY PINE. Tree, to 40, or sometimes to 100 ft., with slender horizontal or pendulous branches in remote and irregular whorls, forming a broad, open pyramid or sometimes flat-topped: winter-buds oblong, dark brown: lvs. stiff, twisted, spreading, acutish, 1½–2½ in. long: cones conic-oblong, reddish brown, 1½–2½ in. long; apophysis little elevated, with a broad, depressed-pyramidal umbo ending in a short recurved prickle: seed pale brown, ¼ in. long. N.Y. to S. C., west to Ky. and Ind. S.S. 11:581.—Hardy as far north as Mass., but of little ornamental merit. Valuable in the Middle States for covering dry and barren soil.


1827.
Old cone of Pitch Pine —Pinus rigida (× ½).

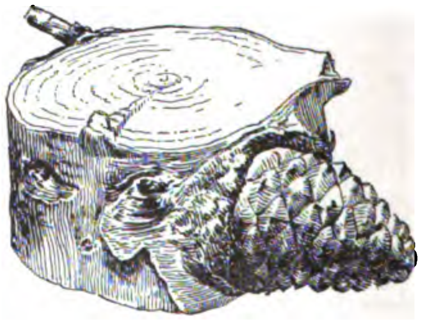
31. **divaricàta,** Dum.-Cours. (*P. Banksiàna*, Lamb.). Tree, to 70 ft., but usually lower and sometimes shrubby, with slender, spreading branches, forming a broad, open head: branchlets yellowish to purplish brown: winter-buds oblong-ovate, light brown, very resinous: lvs. stiff, twisted, spreading, acute or obtusish, dark or bright green, about 1 in. long: cones conic-oblong, usually curved, pale yellow-brown and lustrous, unarmed, 1½–2 in. long, remaining on the tree for 12 or 15 years; apophysis flattened, with a transverse line and a small dark obtuse umbo: seed black, ⅜ in. long. Hudson bay to N. Y., west to Minn. S.S. 11:588.—The most northern of all American Pines and quite hardy, but not of much ornamental value.

32. **claùsa,** Sarg. (*P. ìnops*, var. *claùsa*, Engelm.). SAND PINE. SPRUCE PINE. Figs. 1828, 1829. Tree, to 20, occasionally to 70 ft., with slender, spreading branches: branchlets red-brown: winter-buds oblong, obtuse, not or little resinous: lvs. slender and flexible, acute, dark green, 2–3 in. long: cones short-stalked, often oblique at the base, conic-ovate, dark reddish brown, 2–3½ in. long, remaining closed for 3 or 4 years after ripening and often becoming enveloped by the growing wood of the stem; apophysis depressed pyramidal, conspicuously keeled; umbo with a short, stout spine. Fla. and Ala. near the coast. S.S. 11:582. G.F. 5:161.—Little known in cultivation and not hardy north.

33. **contórta,** Dougl. (*P. Bolánderi*, Parl.). SCRUB PINE. Tree, to 20, occasionally to 30 ft., with rather stout branches forming a round-topped compact or open head, or a tree, to 80 and occasionally 150 ft., with a narrow pyramidal head: branchlets light orange or orange-brown: buds ovate, dark chestnut-brown, resinous: lvs. stiff, twisted, acutish, dark green, 1–3½ in. long: cones ovate or conic-ovate, oblique at the base, 1–2 in. long, light yellowish brown and lustrous, scales of the upper side with elevated, pyramidal apex, the dark umbo ending in a slender incurved spine. Alaska to Calif., west to Mont. and Colo.—Var. **Bolánderi,** Koehne, the typical form, is a low tree, with shorter, 1–2-in. long lvs. and with very oblique cones, often remaining closed for several years after maturity. S.S. 11:567. G.C. II. 19:45. Var. **Murrayàna,** Engelm. (*P. Murrayàna*, Murr. *P. Boursièri*, Carr.), is the form in the Rocky Mts., and a taller tree of pyramidal habit, with longer, 1½–3½-in. long lvs., less oblique cones, opening usually soon after maturity. S.S. 11:568. G.C. 1869:191 and R.H. 1869, p. 278 (as *P. Tamrac*). R.H. 1854, p. 226. In cultivation it is usually a bushy, low tree and seems hardy north.

34. **púngens,** Michx. TABLE MOUNTAIN PINE. POVERTY PINE. Tree, to 30, occasionally to 60 ft., with stout spreading branches forming a broad, open, often flat-topped head: branchlets light orange: winter-buds oblong, obtuse, dark chestnut-brown: lvs. stout, twisted, sharply pointed, dark green, 1¼–2½ in. long: cones conic-ovate, oblique at the base, light brown, 2½–3½ in. long; apophysis pyramidal and conspicuously keeled, the conical elongated umbo ending in a stout curved spine: seed light brown, ¼ in. long. N. J. to N. C. and Tenn. S.S. 11:584.—Hardy as far north as Mass., but of little ornamental value.

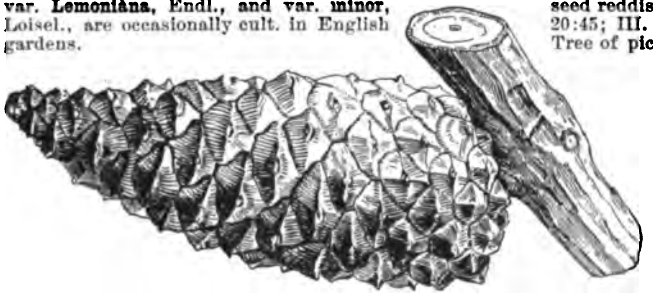
35. **muricàta,** Don. PRICKLE-CONE PINE. Tree, to 50, occasionally to 90 ft., with stout, spreading branches forming a regular pyramid in young trees, in old age usually round-topped and compact: branches orange-brown: winter-buds ovate, dark brown, resinous: lvs. stiff, usually twisted, acute, dark green, 4–7 in. long: cones usually clustered, oblong-ovate, oblique at the base, chestnut-brown, 2–3½ in. long; scales of the upper side with elongated conical apex terminated by a dark triangular spiny umbo, scales of the lower side more flattened, with slender straight spines; the cones usually remain closed for several years after maturity:


1828. Cone of Pinus clausa, grown over by the branch (× ⅔).

seeds almost black, ¼ in. long. Calif. S.S. 11:585, 586. G.F. 10:235. F.S. 5, p. 517. G.C. II. 21:48, 49, 53.—Handsome Pine, with regular, pyramidal head; not hardy north.

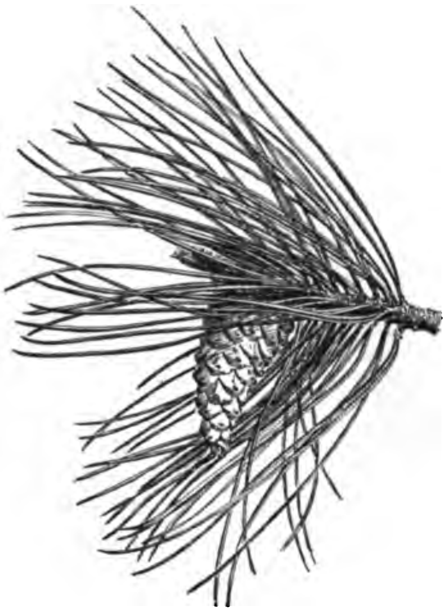
36. **Laricio**, Poir. CORSICAN PINE. Tree, to 100 or occasionally 150 ft., with stout, spreading branches in regular whorls forming a symmetrical pyramid, in old age sometimes broad and flat-topped: branchlets usually light brown: buds ovate or oblong-ovate, light brown, resinous: lvs. stiff, acute, dark green, 3½–6½ in. long: cones sessile, ovate, yellowish brown, glossy, usually 2–3½ in. long; apophysis depressed, conspicuously keeled; umbo flattened, obtuse or with a very short prickle: seeds gray, ¼ in. long. S. Eu. to W. Asia.—Very variable and usually the following 4 vars. are distinguished: Var. **Austriaca**, Endl. (var. *nigricans*, Parl. *P. Austriaca*, Höss. *P. nigra*, Hort.). AUSTRIAN PINE. Figs. 1814, 1830. Tall tree, with broadly ovate head and very dark green, rigid foliage: branchlets grayish brown. S.E. Eu., from Austria to Dalmatia and Roumania. Gn. 19, p. 477; 38, p. 113. Mn. 10, p. 170. R.H. 1894, p. 271. Var. **Calàbrica**, Delam. Tall tree, with shorter ascending branches forming a narrower, less dense head: lvs. of lighter green: branchlets light brown. Italy, Sicily. Gn. 27, p. 321; 29, p. 104; 36, p. 523; 52, p. 219. G.C. II. 21:15; III. 4:693, 705. Var. **Pallasiàna**, Endl. Tall tree, with long and stout branches: lvs. dark green and glossy: cones light brown, about 4 in. long. W. Asia. G.C. II. 20:785; 21:481. Var. **Cebennénsis**, Gren. & Godr. (*P. Sàlzmanni*, Dun. *P. Monspeliénsis*, Salzm. *P. Pyrenàica*, Hort., not Lapeyr. *P. Cebennénsis*, Hort. *P. horizontàlis*, Hort.). Tree, to 60 ft.: branchlets orange-colored: lvs. slender, to 6½ in. long: cones small, about 2 in. long. Var. **pygmæa**, Rauch. Dwarf, dense, bushy form. The first-named var. is the hardiest and hardy north, while the others are at least hardy as far north as Mass. They are of rapid growth and conspicuous by their large, dark green foliage. Var. *Cebennensis* is especially very handsome as a young plant, with its long, dense leaves.

37. **Pináster**, Ait. (*P. maritima*, Poir.). CLUSTER PINE. Tree, to 100 ft., with spreading or sometimes pendulous branches forming a pyramidal head: branchlets bright reddish brown: buds oblong-oval, brown, not resinous: lvs. stiff, acute, usually twisted, glossy green, 5–9 in. long: cones short-peduncled, clustered, conic-oblong, light brown and glossy, 4–7 in. long; apophysis pyramidal, conspicuously keeled with prominent triangular, acute umbo: seed grayish brown, ⅛ in. long. S. Eu., near the coast. Gn. 14, p. 20.—Handsome Pine of regular, pyramidal habit and rapid growth, but not hardy north. In England it is much used for seaside planting and the vars. **Hámiltoni**, Parl., var. **Lemoniàna**, Endl., and var. **minor**, Loisel., are occasionally cult. in English gardens.



1829. Cone of Pinus clausa. Natural size.

38. **Thúnbergi**, Parl. (*P. Massoniàna*, Sieb. & Zucc., not Lamb.). JAPANESE BLACK PINE. Tree, to 100 ft. or occasionally 120 ft., with spreading, often somewhat pendulous branches, forming a broad, pyramidal head: branchlets orange-yellow, the winter buds oblong, grayish or silvery white: lvs. stiff, sharply pointed, bright green, 3–4½ in. long: cones short-stalked, conic-ovate, grayish brown, 2–3 in. long; apophysis flattened, with small, depressed umbo, obtuse or with a minute prickle: seed grayish brown, ¼ in. long. Japan. G.C. II. 23:345. S.Z. 2:113.—Handsome tree and hardy north. Several horticultural vars. have been introduced from Japan: one of the most distinct is var. **Óculus-draconis**, Mayr, each leaf being marked with 2 yellow bands and therefore the tufts of the lvs. at the end of the branches, if seen from above, show alternate yellow and green rings, hence the name *Oculus-draconis* (dragon-eye). Var. **variegàta** has the lvs. partly yellow or occasionally wholly yellowish white. There are also similar forms in *P. densiflora*, which may be distinguished by the brown color of the winter buds.



1830. Austrian Pine—Pinus Laricio, var. Austriaca (× ⅓).

9. *Sylvestres.*

39. **Pinea**, Linn. STONE PINE. Tree, to 80 ft., with long, horizontally spreading branches forming in older trees a broad, flat-topped head: branchlets pale brown: buds with revolute scales, oblong-ovate, not resinous: lvs. rigid, acute, bright green, 5–8 in. long: cones broadly ovate, chestnut-brown, 4–5½ in. long; apophysis depressed-pyramidal, radiately ridged; umbo flat, obtuse: seed reddish-brown, ¾ in. long, edible. S. Eu. G.C. II 20:45; III. 4:604, 605. Gn. 27, p. 245–247; 50, p. 460.—Tree of picturesque habit, with a trunk usually destitute of branches for a considerable height and with a wide-spreading parasol-like head. Not hardy north; in warmer regions often cultivated for its edible seeds.

40. **resinòsa**, Ait. RED PINE. NORWAY PINE. Tree, to 70, occasionally to 150 ft., with stout spreading and sometimes pendulous branches forming a broad pyramidal head when young and an open round-topped one in old age: branchlets orange-color: buds ovate, acuminate, light brown, resinous: lvs slender and flexible, acute, dark green and lustrous, 4–6 in. long: cones subsessile, conic-ovate, light brown, 1½–2½ in. long; apophysis flattened, conspicuously keeled, obtuse, with small dark unarmed umbo; seeds dark brown, ⅛ in. long. Newfoundland to Manitoba, south to Pa. and Minn. S.S. 11:550, 551. A.G. 12:645.—One of the most ornamental Pines for northern parks, quite hardy and of vigorous growth. Lumber tree.

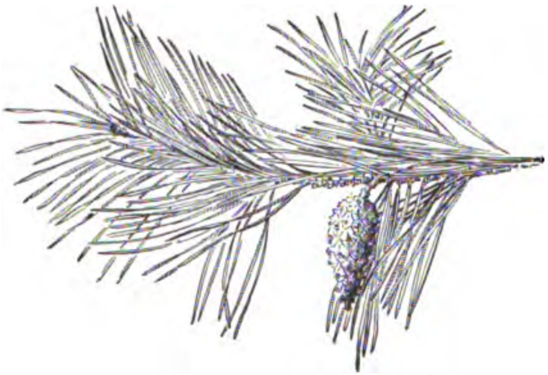
41. **Halepénsis**, Mill. ALEPPO PINE. Tree, to 60 ft., with short branches forming an open, round-topped head: branchlets slender, yellowish or light greenish brown: winter-buds small, cylindric, not resinous: lvs. sometimes in 3's, slender, bluish or dark green, 2½–4 in. long: cones conic-ovate or conic-oblong, yellowish

brown, unarmed, 2½–3½ in. long; apophysis flattened, with a transversal line and a little or not elevated obtuse umbo: seed ¼ in. long. Mediterranean region. G. C. II. 22:553; III. 3:629.—Not hardy north and of little ornamental value, but recommended for seaside planting. Trunk usually slender and destitute of branches for a considerable height: foliage thin and sparse, in tufts at the end of branchlets. Var. **Pithyùsa,** Stev., is a smaller tree with slenderer branches, longer lvs. and smaller cones. W. Asia.

42. **Massoniàna,** Lamb. (*P. Sinénsis*, Lamb.). Tree, to 80 ft., with slender, spreading branches: branchlets yellowish brown: lvs. very slender and thin, light green, 5–8 in. long: cones oblong-ovate or ovate, dull brown, 2–3 in. long; apophysis flattened, slightly keeled, with a small, flat, unarmed umbo: seed 1-5 in. long. China.—Not hardy north and rarely cult. Often confounded with *P. Thunbergi* and *P. densiflora*.

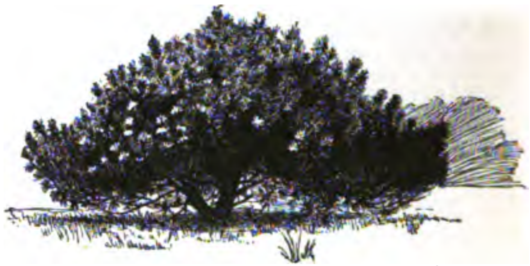
43. **densiflòra,** Sieb. & Zucc. JAPANESE RED PINE. Tree, to 100 ft., with spreading branches forming an irregular, rather broad head: branchlets orange-yellow, bloomy: buds oblong-ovate, chestnut-brown: lvs. slender, acute, bright bluish green, 2½–5 in. long: cones short-stalked, conic-ovate to oblong, grayish brown, somewhat oblique at the base, about 2 in. long; apophysis flattened and slightly ridged, those near the base sometimes elongated; umbo small, with a short prickle or obtuse: seed grayish yellow, ¼ in. long. Jap. S.Z. 2:112.—Ornamental hardy tree, rapidly growing when young, often very picturesque when older. Many garden forms are cult. in Japan, several of them with variegated lvs. The best are perhaps var. **aùrea,** Mayr, with yellow foliage; var. **albo-terminàta,** Mayr, with the tips of the lvs. yellowish white, and var. **Oculus dracònis,** Mayr, like var. **variegàta,** Mayr, similar to the vars. of the same name under *P. Thunbergi*.

44. **sylvéstris,** Linn. SCOTCH or SCOTS PINE. Fig. 1831. Tree, to 70 or occasionally 120 ft., with spreading, often somewhat pendulous branches, pyramidal when young, with broad and round-topped often picturesque head in old age: branchlets dull grayish yellow: winter-buds oblong-ovate, brown, resinous: lvs. rigid, acute, twisted, bluish green, 1½–3 in. long: cones short-stalked, conic-oblong, grayish or reddish brown, 1½–2½ in. long; apophysis little thickened, slightly keeled, only those near the base elongated; umbo small, obtuse: seed dark gray, 1–6 in. long. Eu. to W. and N. Asia. Gn. 36, p. 167; 38, p. 455; 49, p. 296.—One of the most important timber trees of Europe. It is quite hardy, but has little to recommend it as an ornamental tree. Several geographical and garden forms have been distinguished. Var. **argéntea,** Stev. Foliage light bluish green, with silvery hue. Var. **aùrea,** Hort., with the young lvs. golden yellow. Var. **columnàris compácta,** Bailly. Dwarf, dense, columnar form. R.H. 1889, p. 393. Var. **fastigiàta,** Carr. (var. *pyramidàlis*, Hort.). Of pyramidal habit. N. 3:146. Var. **péndula,** Hort. With pendulous branches. Var. **pùmila,** Hort. Dwarf globose bush.



1831. Scotch Pine—Pinus sylvestris (× ⅓).

45. **montàna,** Mill. SWISS MOUNTAIN PINE. Very variable in habit, usually low, often prostrate shrub, sometimes pyramidal tree to 40 ft., similar to the preceding: branchlets usually of darker, brownish color: lvs. bright green, acutish, stout, crowded, ¾–2 in. long: cones ovate or conic-ovate, ¾–2¼ in. long; apophysis often pyramidal; umbo light gray, surrounded by a blackish ring. Mts. of M. Eu. Gn. 30, p. 225. Mn. 5, p. 49.—Handsome hardy low shrub with ascending branches densely clothed with bright green foliage; ornamental as single specimens or for covering rocky slopes and as undergrowth in open woods. A very variable species which has been divided according to the cones into the following 3 vars. or subspecies. Var. **uncinàta,** Willk. (including var. *rostràta* and *rotundàta*, Ant.). Cone very oblique, usually deflexed; apophysis pyramidal, with often reflexed umbo. Often arborescent. Var. **Pumilio.** Willk. (*P. Pumílio*, Hænke. *P. Carpática*, Hort.). Cone regular, subglobose to ovate, before maturity glaucous and usually violet-purple, ripe yellowish or dark brown. Var. **Mùghus,** Willk. (*P. Mùghus*, Scop.). Fig. 1832. Cone regular, conical or conic-oval, with usually prickly umbos, not bloomy, yellowish brown before ripening, cinnamon-brown when ripe.



1832. Mugho Pine—Pinus montana, var. Mughus.

P. Abies, Linn.=Picea excelsa.—*P. albicaùlis*, Engelm. Pyramidal tree, to 30, rarely 60 ft., sometimes shrubby: allied to P. flexilis: bark whitish or light brown: cones smaller, 1½–3½ in., subglobose or oval, purplish brown. Brit. Col. to Calif. and Wyo. S.S. 11:548. G.C. II. 24:9. Probably as hardy as P. flexilis.—*P. Alepènsis*, Poir.=P.Halepensis.—*P. Arizónica*, Engelm. Tree, to 100 ft., with pyramidal or open, round-topped head: allied to P. Torreyana: lvs. shorter, 5–7 in. long: cones smaller, 2–2½ in., with recurved spines. Ariz. S.S. 11:550.—*P. Armándi*, Franch. Chinese species, allied to P. parviflora. Young plants without name, raised from Chinese seed in the Arnold Arboretum, seem to belong here: similar in foliage to P. Koraiensis, but branchlets glabrous: lvs. 3–4½ in. long, with peripheral resin-ducts. Has proved hardy and promises to become an ornamental Pine.—*P. Brùtia*, Ten.=P. Pyrenaica.—*P. cembroìdes*, Zucc. (P. osteosperma, Engelm.). Bushy tree, with round-topped head, to 30, rarely to 60 ft.: allied to P. edulis: lvs. slenderer, bright green, 1½–2 in. long: cones somewhat larger. Ariz. to Calif. and Mex. S.S. 11:550. G.F. 4:353. F.S. 4, p. 325 b.—*P. Chihuahuàna*, Engelm. Allied to P. ponderosa, but very distinct by its deciduous sheaths: tree, to 40, rarely 60 ft.: lvs. slender, pale green, 2½–4 in. long: cones broadly ovate, 1½–2 in., with small, recurved prickles. Calif. to N. Mex. and Mex. S.S. 11:566. G.F. 8:24. Tender and of little ornamental value.—*P. Gerardiàna*, D. Don. Tree, to 60 ft., with broad, round-topped head: allied to P. Bungeana: lvs. bluish green, 2½–4 in. long: cones 6–9 in. long, with the tips of scales reflexed: seeds short-winged, to 1 in. long, edible. Himal. Not hardy north.—*P. glàbra*, Walt. CEDAR PINE. SPRUCE PINE. Pyramidal tree, to 80, rarely 120 ft.: allied to P. echinata: lvs. dark green, 1½–3 in. long: cones broadly to oblong-ovate, 1¼–2 in. long. S.C. to Fla. and La. S.S. 11:583. Hardy only south. —*P. Gordoniàna*, Hartw.=P. Montezumæ.—*P. Grenvílleæ*, Gord.=Montezumæ.—*P. Héldreichi*, Christ. Small tree, allied to P. Laricio: lvs. 3–4 in. long: cone 3 in. long, with impressed dull umbo furnished with a small curved prickle. Greece. G.C. II. 21:740.—*P. insularis*, Endl. Tall tree: lvs. 3, flaccid and very slender, 7–9 in. long: cones conic-ovate, 2½–3 in. long: scales with low pyramidal, sharply keeled apex and obtuse or on the upper scales mucronulate umbo. Philippine Islands. Not yet introduced.—*P. latifòlia*, Sarg. (P. Mayriana, Sudw.). Tree, to 60 ft., allied to P. ponderosa: lvs. 12–15 in. long and 1–16 in. wide: cones oblique at the base, 3–4 in. long. Ariz. S.S. 11:565. G.F. 2:496; 8:25. Not hardy north.—*P. latisquàma*, Engelm. Allied to P. Parryana: lvs. 5, slender, 1½–2 in. long: cones peduncled, cylindric-ovate, 3–4 in. long; apophysis depressed and obtuse. Mex. G.C. II. 18:713.—*P. leucodérmis*, Ant. Tree, to 80 ft., with pyramidal head: allied to P. Laricio: bark light gray: lvs. dark green, 2–4 in. long: cones oblong-ovate, light grayish brown, dull, about 3 in. long. S. E. Eu. Probably hardy north.—*P. Mayriàna*, Sudw.=P. latifolia.—*P. macrophýlla*, Lindl., not Carr.=P. Montezumæ.—*P. Montezùmæ*, Lamb. (P. Gordoniana, Hartw. P. Grenvilleæ, Gord. P. macrophylla, Lindl., not Carr.). Tree, to 80 ft. and more: allied to P. Torreyana: lvs. glaucous or green, 7–16 in. long: cones 4–14 in. long, light brown; apophysis depressed pyramidal, with a short, recurved spine. Mex. G.C. III. 8:465–467, 475; 15:271,273. Gn. 56, p. 481; 58, p. 397. Very variable species, as the numerous (about 70) synonyms show. Not hardy north.—*P. osteospérma*, Engelm.=P. cembroides.—*P. pátula*, Schiede. Allied to P. Tæda: tree, to 80 ft.: lvs. sometimes 4 or 5, drooping, light green, 7–9 in. long: cones oblong-ovate, oblique, with depressed knobs, 4 in. long. Mex. G.C. II. 23:108, 109, 117; III. 9:435. Graceful tree, but not hardy north.—*P. pentaphýlla*, Mayr. Allied to P. parviflora, but seeds long-winged, two-fifths in. long: lvs. stouter and longer, with conspicuous white lines inside: cones 2½–4 in. long. Japan. Probably as hardy as P. parviflora.—*P. Picea*, Linn.=Abies Picea.—*P. pùmila*, Regel. (P. Cembra, var. pumila, Pall.). Shrubby, often procumbent, allied to P. Cembra, but resin-ducts of lvs. peripheral: lvs. 1¾–3 in. long: cone 1½ in. long: seed two-fifths in. long. N. E. Siberia to Japan. Hardy.—*P. Pyrenàica*, Lapeyr. (P. Brutia, Ten.). Tree, to 50 ft.: allied to P. Halepensis: lvs. twice as long, 5–7 in., bright green: cone oblong, 2–4 in. long, with rugose depressed knobs. S. Eu., W. Asia. G.C. III. 4, p. 268. Not hardy north; often confounded with P. Laricio, var. Salzmanni, from which it is easily distinguished by its greenish to reddish brown branchlets.—*P. refléxa*, Engelm.=P. strobiformis.—*P. serótina*, Michx. POND PINE. MARSH PINE. Tree, to 50, occasionally to 80 ft.; allied to P. Tæda: lvs. dark yellowish green: cones 2½–3 in. long, with slender, incurved deciduous prickles, remaining closed for 1 or 2 years after maturity. N. C. to Fla. S.S. 11:580. Not hardy north.—*P. st.obifórmis*, Engelm. (P. reflexa, Engelm.). Tree, to 100 ft.; allied to P. flexilis: lvs. remotely and minutely serrulate or almost entire, slender, 2½–4 in. long: cones 5–9 in. long, with reflexed knobs. Ariz. S.S. 11:544, 545.

ALFRED REHDER.

PÌPER (the ancient Latin name). *Piperàceæ*. PEPPER. A vast genus (probably 600-700 species) of both the Old and New Worlds, mostly in the tropics, a few of which are in cultivation in this country as greenhouse foliage plants. In choice collections one is likely to find several other species, but as they seldom fruit it is very difficult to determine their species. In the following list appear all the names that occur in the American trade. Piper is an exceedingly difficult genus to the systematist because of the great numbers of species, the variation of foliage in the same plant at different epochs, the difficulty of matching the sexes of the same species, the imperfect specimens in herbaria, and the scarcity of good studies of the plants in the wild. In nearly all cases, Pipers are diœcious. The flowers are very minute, and are borne beneath decurrent bracts in slender, erect or drooping, axillary spikes; perianth none; stamens usually 1–4: ovary 1-loculed, with a solitary erect ovule. The fruit is a small globular drupe or berry. The leaves are alternate, stipulate, usually entire. Pipers are mostly climbing shrubs, but some are trees and some herbs. The Pepper of commerce is the product of *P. nigrum*. For Red Pepper and Chile Pepper, see *Capsicum* and *Pepper*.

Pipers are easy of cultivation. Most of those known in our houses require a warm-house temperature and a humid atmosphere. Easily multiplied by cuttings of the firm wood. They are grown for the decorative value of their drooping or bushy sprays.

A. *Plant erect and bushy.*

excélsum, Forst. Glabrous shrub, reaching 20 ft. in some of its native places: lvs. cordate-orbicular to ovate, stalked, short-acuminate, 7–9-nerved from the base, the blade 2–4 in. across: spikes solitary or in 2's, short-peduncled, the staminate ones 2–3 in. long and the bracts peltate, the stamens 2 or 3; pistillate spikes shorter, the fls. with 3 stigmas. New Zealand and other South Pacific islands.—Offered in Calif. Lvs. aromatic.

AA. *Plant climbing, or drooping when not given support.*

B. *Lvs. ovate-lanceolate, deciduous.*

Futokadsùra, Sieb. JAPANESE PEPPER. Clinging closely to walls by its aërial roots: lvs. ovate-lanceolate and acuminate, cordate at base, glabrous: fls. greenish: berries red. Japan.—Handsome plant, standing considerable frost.

BB. *Lvs. broadly ovate or roundish, evergreen.*

nigrum, Linn. BLACK PEPPER. Plant woody below; stem strong, terete, emitting roots, tall-climbing, glabrous: lvs. thickish, stalked, broadly ovate-oblong or nearly orbicular, the base usually rounded and oblique, 5–9-nerved above the base, the nerves alternate: fls. sometimes polygamous but usually diœcious: fr. globose, red. Old World tropics, but now widely dispersed in warm countries. B.M. 3139.—Occasionally grown in hothouses, particularly amongst collections of economic plants. In the wild it is a strong climber, rooting at the nodes, sometimes reaching 20 ft. in height. The dried berries, which are collected before ripe, are black and wrinkled, and constitute the Black Pepper of commerce. When the outer skin is removed from the fruit, the product is White Pepper. The commercial Pepper comes mostly from the eastern tropics.

ornàtum, N. E. Br. Climbing, 10–15 ft. tall, glabrous, rooting at nodes: lvs. glabrous "and directed to one side;" petioles slender and nearly terete, the blade peltate, ovate-orbicular, with a short, rather blunt point, the nerves 7 but not prominent above and uniting in loops on the margin, the upper surface of the young lvs. shining green and covered with pinkish spots, the old lvs. duller and whiter-spotted. Celebes.

metállicum, Lindl. Lvs. thick, rounded, handsome metallic green. Borneo.

P. Bètle, Linn. BETEL (which see). Climbing, nearly or quite glabrous: lvs. large and thick, ovate-oblong-acuminate, usually oblique at base, strongly 5–7-nerved: spikes often 4-6 in. long: fr. very fleshy, often cohering into a long-cylindrical mass. Eastern tropics. B.M. 3132. Lvs. chewed by natives, and the plant much cultivated.—*P. Cubéba*, Linn. (Cubeba officinalis, Raf.). CUBEB. Climbing or tree-like: lvs. glabrous, oval, short-acuminate, obliquely cordate, the upper ones smaller and oval-oblong: fr. resembling those of P. nigrum, but stalked. E. Indies. The fr. is employed in medicine.—*P. porphyrophýllum*, N. E. Br. (Cissus porphyrophylla, Lindley, and of horticulturists). Handsome climbing foliage plant with broadly cordate-oval short-pointed lvs. that are purple beneath and bronzy green and pink-spotted along the veins above. Probably E. Indies. F. S. 14:1491. R.H. 1883, p. 560. Lowe, 59.—*P. rubronodòsum*, Bull. Shrub, with red-jointed roughish stems: lvs. cordate-ovate, somewhat blistered, silvery gray, the petiole pubescent. Colombia.—*P. rubrovenòsum*, Hort. Climbing: lvs. cordate-ovate acuminate, marked with rose-colored dots and streaks along the veins. Very like P. ornatum, and perhaps not distinct. Papua. I.H. 34:33.

L. H. B.

PIPPERIDGE s an English name of the Barberry; for Pepperidge, see *Nyssa*.

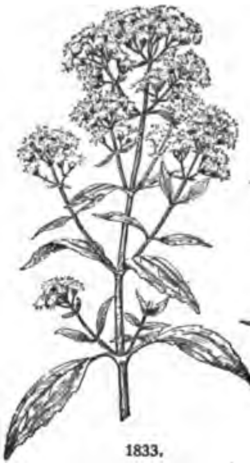
PIPSISSEWA. See *Chimaphila*.

PIPTADÈNIA (Greek, *falling gland;* referring to the anther). *Leguminòsæ*. About 45 species of shrubs or trees, with or without prickles: lvs. bipinnate: peduncles axillary, solitary or clustered: fls. small, white, sessile, in cylindrical spikes or globose heads; petals usually connate to the middle, valvate; stamens 10, free: pod straight or curved, flat, 2-valved; valves entire, not septate within.

Cebíl, Griseb., from the Argentine Republic, is a fast-growing unarmed tree, attaining 60 ft., int. by Franceschi, Santa Barbara, Calif., for its economic interest. It is valued in its native land for tan bark. Pinnæ 12–16-paired; lfts. 24–40-paired: fls. white, in globose heads about ½ in. in diam. including the stamens: peduncles ¾–1 in. long: corolla funnel-shaped, 1½ lines long; stamens 10, distinct, long-exserted: pod 6–8 in. long, 8–10 lines wide, straight but sinuate between the seeds.

J. B. S. NORTON.

PIQUÈRIA (A. Piquerio, Spanish botanist of eighteenth century). *Compósitæ*. Under the name of *Stevia serrata* or *S. serratifolia*, florists grow **Piqueria trinérvia**, Cav. (Fig. 1833), for its small white fragrant flowers and for bedding. It resembles a small Eupatorium in foliage and flowers. The small heads are borne in small panicled corymbs, each cluster terminating a slender axillary branch or peduncle. The leaves are opposite, lanceolate to oblong-lanceolate, serrate-dentate, very short-stalked. There is a dwarf, compact form (var. **nàna**, Hort.), and also one with broadly white-edged leaves (var. **variegàta**, Hort., Fig. 1834), which are much used for bedding out. The Piqueria endures both sun and shade, and thrives with even indifferent treatment. For flowers, it is much prized in winter, when delicate white sprays are not abundant. It demands the general treatment given zonal geraniums. Prop. by cuttings with great ease, and beginning to bloom when only 2 or 3 in. high. It often blooms in the cutting-bed. It also grows readily from seeds, which are handled by seedsmen. Frequent pinching will keep the plants within bounds and contribute to floriferousness. Plants allowed to grow as they will soon become straggly and wiry. For winter bloom the plants may be handled in pots or grown in beds. A stock of compact pot-plants kept in a cool corner is very useful for filling vacancies in the house.



1833.

Piqueria trinervia (× ½). Known to florists as *Stevia serrata.*

1834.

Marginate form of Piqueria trinervia.

Piqueria trinervia is native in Mexico. It is perennial. B. M. 2650. The genus contains about 10 species of herbs or bushes, all of tropical America. The heads contain 3–5 whitish tubular fls.: torus plane or convex, naked: pappus none or very short: akene 4–5-angled.

L. H. B.

Usually the best way to manage to produce good flowering plants of Stevia in midwinter is to save a few old plants after the flowers are cut at New Years. Cut off the old stems 5 or 6 inches above the pots and stand the plants in any cool house. The plant needs the coolest house at all times; 40° at night during the winter will grow it better than a higher temperature, but, for all that, it does not endure the slightest frost. About March 1, these old plants will have sent out any number of small growths from the base of the stems. These root very readily in a cool propagating house. They should then be grown along, first in 2- and afterward in 3-inch pots, until the first of June, when they should be planted out in the open ground. It need not be very rich ground, for they are very rampant growers. Give every plant 2 feet of space. They seldom need any artificial watering during summer, but they should have frequent pinching to produce bushy plants. The more shoots, the more flowers will be secured. Before there is any danger of frost in the fall, the plants should be lifted and put into 6-, 7-, or 8-inch pots. They lift well, and if stood in the shade and kept syringed for a few days they will show no bad results of the lifting. A position at the north side of a shed or wall is much better for them for the next month than under glass, but always have them in a position where they can be protected in case of a frost. By the end of October, if frost is escaped, put them in the lightest and coolest house available. If kept cool these very desirable sprays of flowers will be in perfection at Christmas, and that is the time they are most valuable. Although classed as a common, cheap flower, there is a grace about Stevias that makes them indispensable for many of our flower arrangements, and we consider them a very needful florist's plant.

Wm. Scott.

PIRONNEÀVA. See *Æchmea.*

PISCÍDIA (Latin, *fish* and *kill*). *Leguminòsæ.* A genus of 1 or 2 species, including the Fish-poison tree of the American tropics, or Jamaica Dogwood. The leaves, bark and twigs of this tree when thrown into the water intoxicate or stun the fish so that they can be caught readily. (For the plant used in China for this purpose, see *Cocculus.*) The bark has also been used in medicine for its hypnotic effect. Botanically this genus is close to Lonchocarpus, differing mainly in the pod, which is long, thickish and longitudinally 4-winged. Generic characters: calyx-teeth 5, short, broad: wings adhering to the falcate keel: vexillar stamen free at the very base, but grown together at the middle with the others into a closed tube: ovary sessile, many-ovuled.

Erythrìna, Linn. Fish-poison Tree. Jamaica Dogwood. Lfts. 7–11, opposite, oblong or elliptical, pointed or blunt: fls. purplish white, ⅓ in. across: pod 2–4 in. long, 4 lines broad; seeds 6–8, black. Trop. Amer., especially common in Jamaica.

PISTACHIO. See *Pistacia.*

PISTÀCIA (derived indirectly from ancient Persian *pista*). *Anacardiàceæ. P. vera* produces the Pistachio-nuts of commerce, which are much used in confectionery and flavoring. The so-called nut is really the seed or kernel of a dry drupe. The seed is green, and has a highly peculiar flavor. *P. Terebinthus* exudes from its stem the fragrant Cyprian or Scio-turpentine used in medicine as early as the time of Hippocrates. Pistacia is a genus of about 10 species of trees, found from the Mediterranean region to Afghanistan, with 1 species in the Canaries and 1 in Mexico. Lvs. alternate, evergreen or deciduous, odd-pinnate: fls. small, in axillary panicles or racemes, diœcious and without petals; males with 5-cut calyx and 5 stamens; females 3–4-cut and with 3-cut style: ovary 1-celled. Engler, DC. Monogr. Phaner. 4:284–293 (1883).

vèra, Linn. Pistachio-nut. Small tree attaining 20 ft.: lfts. 3 or 5: fr. large, oblong, acute. Mediterranean region and Orient. Cult. in S. California, Calif. May be grafted on *P. Terebinthus.*

P. Terebinthus, Linn. A small turpentine-producing tree: lfts. 9–13, mucronate; petiole not winged: stamens pink: stigmas red: fr. small, roundish. Southern Europe, Mediterranean region. In the European form the terminal lft. is about as long as the others, but in the oriental form it is minute or lacking. Mentioned in the lists of Amer. Pomological Society as a cultivated fruit, as is also *P. vera.*

PÍSTIA (probably from Greek, *pistos*, watery; referring to its aquatic nature). *Aràceæ.* Water Lettuce or Tropical Duckweed is a small, tender, perennial floating herb desirable for aquaria. It forms a loose rosette of lvs. and has long, slender, feathery roots. The plant sends out runners on which may sometimes be seen young plants in all stages of development. A healthy plant measures about 6 in. across. The lvs. are generally more or less wedge-shaped, 2–5 in. long, pea-green, velvety to the touch, and covered beneath with a sort of mealy down. The Pistia rosette has been compared to a half-grown lettuce plant before the head has formed. Like many other aquatics, the Water Lettuce has an immense range. It is found in fresh waters throughout the tropics, and in America is said to be native as far north as North Carolina.

Water Lettuce is commonly grown outdoors in summer in collections of tender aquatics, and also in aquaria. The summer temperature of the water should be 70°–80° F. Although it grows well when floating free in several feet of water, it seems to do better when placed in shallow water where the roots may reach the soil. Larger-sized plants may be secured by using a thin layer of rich soil or well-rotted manure in the bottom of the vessel. Soft water is said to be essential. Running water is not necessary. The plants should be shaded during the middle of the day in summer, or the foliage is likely to become yellow and sickly-looking. In winter the plants are liable to some decay.

Botanically, the genus Pistia is unique. The latest monographer of the aroids (Engler, in DC. Monogr. Phaner. 2, 1879) makes Pistia the sole representative of a subfamily, one of his 10 primary natural divisions of the Arum family. He regards the Pistias as all one species, though 9 or more have been described. He recognizes 4 well-marked varieties, based upon the shape of the lvs., which he calls *cuneata*, *spathulata*, *obcordata* and *linguiformis*. After the continental fashion Engler takes no one of these as a type to which the others are referred. It is probable that the form with obcordate lvs. is the one chiefly cult. in American water gardens. Generic characters: fls. unisexual; spadix without appendage, adnate to the back of the spathe; male fls. in whorls, with 2 very short stamens which are much grown together and inserted at the apex of the spadix; female fls. solitary: ovary 1-celled; ovules numerous, orthotropous, in 4–6 series; fr. baccate, irregularly breaking open, normally with many seeds.

Stratiòtes, Linn. Water Lettuce. Tropical Duckweed. Tender perennial aquatic herb described above. The small white fls., though inconspicuous and borne at the bottom of the cup of lvs., are large enough to show at a glance their relation to the Arum family. B.M. 4564. F.S. 6:625.
W. M.

PÌSUM (Greek and Latin name of pea). *Leguminòsæ.* About 6 species of mostly climbing herbs of the Mediterranean region and eastward, one of which, *P. sativum*, is the common Pea. Calyx-tube oblique at the base, the lobes more or less leafy; standard obovate or orbicular; wings adhering to the keel; style mostly rigid, widened above, bearded down the inner margin: lfts. 1–3 pairs, the leaf ending in a tendril or point, the stipules conspicuous. Annual or perennial, of easy culture. Hardy.

1835. Pisum sativum (× ½).

sativum, Linn. Garden Pea. Fig. 1835. Annual, glabrous and glaucous, tendril-climbing: stipules large and leafy (usually as large as lfts.): lfts. oval or ovate, 2–3 pairs, the leaf ending in tendrils: fls. few, on an axillary peduncle, white: seeds globular. Eu., Asia. See *Pea.*

Var. **arvénse**, Poir. (*P. arvénse*, Linn.). Field Pea. Fls. usually bluish or dull white, with purple wings: seeds angular, often gray. Grown for forage.

formòsum, Stev. (*Orobus formòsus*, Stev. *Láthyrus frígidus*, Schott & Ky. *Pisum Aucheri*, Jaub. & Sp.). Perennial, 1–2 ft. tall, not climbing: stipules sagittate-ovate: lfts. 1 pair, small, ovate-rhomboid, entire, mucronate: peduncles 1-fld., the fls. purplish: legume smooth, as also the ovate seeds. Asia Minor, Persia.—The *Orobus formosus* that has appeared in the trade seems not to be this plant, for the cult. plant is described as having "dense spikes of purple flowers." It is not known to the writer whether the true *P. formosum* is in the trade.
L. H. B.

PITÁNGA. *Eugenia Micheli.*

PITCÀIRNIA (W. Pitcairn, a London physician). *Bromeliàceæ.* Mez, the most recent monographer of the bromeliads (DC. Monogr. Phaner. 9), admits 134 species of Pitcairnia. They are American, mostly tropical. In choice collections, various species of Pitcairnias may be expected, but very few of them are in the American trade. They are billbergia-like, very short-stemmed perennial herbs or subshrubs with dense rosettes of narrow, often prickly-margined leaves, and a central spike or raceme of long-tubular red, yellow or nearly white flowers. The fls. are perfect; sepals 3, free; petals 3, unguiculate, erect or spreading at the apex, usually with 2 small scales at the base; stamens 6, free, with linear anthers: fr. a 3-valved capsule, with numerous seeds. See also Baker in Journ. Bot. 1881. For pictures of two Mexican species, *P. Jaliscana* and *P. Palmeri*, see G.F. 1:197 and 211. *P. farinosa* is an undetermined trade name. For other species, see *Puya.*

For culture of Pitcairnias, follow advice given under Billbergia.

corallina, Lind. & André. Stemless: outer lvs. hard and dry, without marginal spines, the inner ones with brown-spined petioles and broad plicate recurved blades which are somewhat scurfy on the back: peduncle about 1 ft. long, bright red, the raceme of about equal length and drooping: fls. coral-red, about 3 in. long, the calyx part comprising about one-third of this length; stamens as long as the petals, with white filaments; stigmas twisted. Colombia. R.H. 1875:250. B.M. 6600.—Perhaps the best species.

Moritziàna, Koch (*P. Klotzschiàna*, Baker). Stemless: lvs. linear, in a rosette, 12–18 in. long, usually spineless and the petiole short or none: raceme 1 ft. or less long, on a leafy peduncle of about the same length: fls. red or yellowish, usually not 3 in. long. Guatemala.

cærùlea, Benth. & Hook. (*Pùya cærùlea*, Lindl.). Foliage pineapple-like, with linear very acute lvs. 2 ft. long, which are spinose-dentate and nearly glabrous: peduncle 3–4 ft. tall, the bracts membranaceous, the inflorescence somewhat branched but not loose: fls. narrow-tubular, the petals blue and oblong-obtuse, the sepals much shorter and green and obtuse; alternate stamens shorter. Chile. B.R. 26:11.

alpéstris (*P. cærùlea*, Baker. *Pùya Whýtei*, Hook. f. *Pùya alpéstris*, Poepp.). Flower-cluster much branched or panicled, with bracts more serrate than in *P. cærulea:* fls. very large and showy, with a flaring mouth, dull metallic blue. Chile. B.M. 5732.—A plant in bloom has the habit of a yucca. This and *P. cærulea* will probably stand considerable frost.

heterophýlla, Beer (*P. Morrénii*, Lam. *Pùya heterophýlla*, Lindl.). Stemless: lvs. of two kinds, the outer ones narrow and spiny, brown, and being the termination of bulb-like scales, the later ones being longer (16–24 in.) and green and entire: fls. flesh color or light red, in a close oblong spike that is shorter than the green lvs., the latter arising, however, from separate shoots. Mex. to Venezuela and Ecuador. B.R. 26:71.—Odd.
L. H. B.

PITCHER PLANTS are carnivorous plants bearing pitchers which in some cases contain a liquid secreted by the plant by the aid of which the plant digests the bodies of insects. The native Pitcher Plants of our northern and southern states are Sarracenias. The California Pitcher Plant is described under Darlingtonia. The favorite Pitcher Plants of greenhouses are Nepenthes. All these plants have a morphological resemblance in their pitcher-bearing foliage, but their flowers and seeds are so apparently unlike that they suggest derivation from widely different parts of the vegetable kingdom. The genus Nepenthes might possibly be derived from the Aristolochia family, being a degenerate along one line, while the parasitic Cytinaceæ might be regarded as having degenerated along another line from the same source. The Australian genus Cephalotus, which has a pitcher strikingly like the pitchers of Nepenthes, may be a wayward relative of the Saxifrage family. Sarracenia, Darlingtonia and the Venezuelan genus Heliamphora seem to be more closely allied to one another than to the others and make up the Sarraceniaceæ. These are similar in stamens, style and seed to the poppy family.

PITHECOCTÈNIUM (Greek, *monkey's comb;* from the fruit, which is covered with spurs or warts). *Bignoniàceæ.* About 23 species of tropical American bignonia-like climbers, with racemes of rather large, trumpet-shaped white fls. They are mostly natives of Brazil or Mexico. They belong to a group of genera characterized by having a short and thick capsule (ovoid or oblong), and the seeds arranged more or less distinctly in 2 or more rows, while Bignonia belongs to a group of genera characterized by a long, linear capsule and seeds arranged in a single row. Generic characters: calyx truncate or minutely 5-toothed; corolla-tube gradually swollen above the cylindrical base, often incurved, limb somewhat 2-lipped, lobes 5, rounded, spreading; stamens 4, didynamous, fixed to the cylindrical part of the tube: capsule densely covered with prickles or warts. The lvs. have 3 lfts., or the terminal one is sometimes lacking or transformed into a tendril as in the 2 species below. The following are cult. in S. Calif.

A. *Fls. completely white.*

clematideum, Griseb. (*Anemopægma clematideum*, Griseb. *Bignònia álba*, Hort. not Aubl., according to Franceschi). Lvs. sometimes with 3 lfts., sometimes with 2 lfts. and a tendril; lfts. ovate, suddenly contracted into a long, blunt acumen, very shortly wedge-shaped at the base: cymes terminal, few-fld., racemiform or corymbiform. Argentine.—Grisebach says his *Anemopægma clematideum* must be transferred to Pithecoctenium because of the sessile, muricate capsule, the septum slightly reduplicate at the margin and the hilum of the seeds linear, although it approaches the smooth seed of Anemopægma. (Anemopægma differs from Pithecoctenium in having a smooth capsule and seeds in a single series.)

AA. *Fls. white, yellow-throated.*

muricàtum, Moq. Lfts. cordate, acute: fls. in a terminal, many-fld. raceme; corolla 1 in. long: fr. 3 in. long. Mex.

P. buccinatòrium, Mairet. See Bignonia. W. M.

PITHECOLÒBIUM (Greek, *monkey's ear*). *Leguminòsæ.* A hundred or more species of tropical shrubs or trees, with or without stipular spines: lvs. bipinnate: fls. usually white, pentamerous, or rarely hexamerous; corolla tubular or funnel-shaped; stamens few or very many. For distinction from near allies, see *Inga*. These plants are cult. in the South, especially Calif., for shade and forage.

A. *Plants spiny.*

B. *Lfts. 1 pair.*

dúlce, Benth. (*Inga dúlcis*, Willd., not Mart.). Small tree: lvs. bipinnate; pinnæ 2 pairs; lfts. usually 1 pair, much narrower on one side of the midrib and with a nearly straight margin, the other side broader, obtuse, but with a minute point at the tip on the upper surface, and a small gland between the forking petioles; petioles hairy, shorter than the lfts.: stipular spines very short and straight: racemes terminal: fls. white: pod twisted, red, glabrous. Mexico, Philippines. Consult *Inga*.

BB. *Lfts. 5–10 pairs.*

Mexicànum, Rose. Tree, 15–20 ft. high: lvs. with straight, stipular spines (sometimes wanting) 1 line long; pinnæ 2–5 pairs; lfts. 5–10 pairs: inflorescence paniculate: fls. in heads, pedicelled. Mexico, where it is commonly called *chino.*—J. N. Rose says that it has much the habit of the Mesquit, is valuable for its wood and is rapidly becoming exterminated.

BBB. *Lfts. 10–20 pairs.*

brevifòlium, Benth. Shrub: pinnæ 3–5 pairs; lfts. 10–20 pairs, oblong-linear, 2–3 lines long. Along the Rio Grande in Texas, where the evergreen foliage is said to be readily eaten in winter by sheep and goats. —Franceschi says the whitish fls. are much sought by bees.

AA. *Plants spineless.*

Samán, Griseb. Tall tree: pinnæ 2–6 pairs; lfts. 2-7 pairs, obliquely obovate or obovate-oblong: corolla yellowish; stamens light crimson. The fls. are balls of red stamens an inch or two in diameter. Trop. Amer. G.C. III. 11:557.—Called Rain-tree because it bursts into leaf and flower at the beginning of the rainy season. A rapid-growing tree planted throughout the tropics for its dense shade and also because its pods filled with rich sugar pulp are eagerly eaten by cattle and horses. W. M.

PITS will be discussed under *Winter Protection*.

PITTÓSPORUM (Greek, *pitch seed;* in allusion to the resinous coating of the seeds). *Pittosporàceæ.* About 100 species of hardy or half-hardy evergreen shrubs or small trees, met with chiefly in the southern hemisphere and largely in Australasia. Lvs. alternate, mostly entire, the terminal ones in subverticillate rosettes: fls. mostly solitary or umbellate in the axils of the terminal lvs., regular, the parts in 5's; sepals distinct or connate at base; petals connivent or cohering at base: ovary 1-celled; placentæ 3, parietal; style 1; stigma 1: fr. a globular woody pod, 2–many-seeded. Handsome, often fragrant evergreen shrubs cult. in the greenhouse at the East, in the open in Calif. and the South. Prop. by seeds, or cuttings of the half-ripened wood. J. Burtt Davy.

Pittosporums at Los Angeles: *P. undulatum* is used considerably for hedges, for which purpose it is very good. A specimen in Singleton Court about 25 years old is more than 25 ft. high. It seeds very profusely each year, and the blossoms are very sweet in smell and, owing to their great number, make a fine show. This tree is nearly as far through the top as it is high. *P. nigricans* or *P. eugenioides* do not grow as compact. The undersigned knows of some specimens of *P. eugenioides* that are 35 ft. high and 12 ft. through the top. The only other kinds at all common here are *P. viridiflorum*, *crassifolium*, *Tobira* and its var. *variegatum* and *P. tenuifolium*. The latter is similar to what goes here under the names of *P. eugenioides* or *nigricans*, except that the lvs. are about one-third the size. *P. revolutum* and *rhombifolium* are less known in cultivation here. Ernest Braunton.

INDEX.

crassifolium, 1.
eugenioides, 3.
nigra, 2.
nigricans, 2.
phillyræoides, 4.
Ralphii, 1.
revolutum, 6.
rhombifolium, 7.
tenuifolium, 2.
tetraspermum, 9.
Tobira, 10.
undulatum, 8.
variegatum, 10.
viridiflorum, 5.

A. *Fls. chocolate to almost black: seeds black.*

1. **crassifòlium**, Soland. (*P. Rálphii*, Kirk?). Karo. Tall shrub or small tree of pyramidal growth, rarely exceeding 30 ft.: lvs. 2–3 in. long, very obtuse, thick and leathery, glabrous and dark green above, clothed beneath with dense white tomentum: pedicels ¾–1 in. long: fls. ⅛ in. long; sepals linear, densely pubescent: fr. 1 in. long; seeds ripen in about five months. March, April. New Zealand. G.C. III. 26:205. F.S. 21:2151. B.M. 5978.—Useful for ornamental planting on account of its pale, somewhat glaucous foliage: hardy and especially valuable for wind-breaks along the coast, withstanding the severest gales and uninjured by the ocean spray.

2. **tenuifòlium**, Gærtn. (*P. nigricans*, Hort. *P. nigra*, Hort.?). Tawhiwhi. Small tree, 20–40 ft. high, of symmetrical and compact growth: lvs. 1½–2 in. long, acute, thin, dull green, glabrous and shining: pedicels ¼ in. long: fls. ½ in. long; sepals oblong, acute, glabrous: fr. ⅓ in. long; seeds black. April. New Zealand.—Used in Calif. for clipped hedges and mass planting.

AA. *Fls. yellow or greenish yellow.*

B. *Plant glabrous throughout: sepals very short.*

3. **eugenioides**, A. Cunn. TARATA. Small tree, 20–40 ft. high: lvs. bright yellowish green, shining, handsome, 3–4⅓ in. long, acute; margins often undulate: fls. ¼ in. long or less, partially monœcious or diœcious; sepals very acute: fr. ¼ in. long, apiculate; seeds mature in about 12 months. April. New Zealand.—In Calif. the most extensively cult. species, much used for clipped hedges and ornamental shrubbery; hardy; growth rapid. A variegated variety is cult. in Europe.

4. **phillyræoides**, DC. Small, graceful tree or slender shrub with the habit of a weeping willow: lvs. 2–4 in. long, with a small hooked point: fls. ⅓ in. long, solitary, yellow, often diœcious; sepals very obtuse: fr. ½ in. long, oval, much compressed, yellow; seed dark or orange-red. Deserts of interior Australia.

5. **viridiflòrum**, Sims. CAPE PITTOSPORUM. Shrub, 6 ft. high: lvs. obovate, obtuse and retuse, glabrous, shining and reticulate beneath: fls. in somewhat globose panicles, greenish yellow, jasmine-scented: pedicels glabrous. Cape Colony. B.M. 1684.—Int. by Franceschi, as also was No. 4.

BB. *Plant with lower side of lvs., young shoots and pedicels densely clothed with rusty tomentum: sepals ¼ in. long.*

6. **revolùtum**, Dryand. Tall shrub: lvs. 2⅓–3 in. long, 1–1⅓ in. wide, acutish: fls. ⅓ in. long, yellow; sepals acuminate, tips recurved: fr. ½–¾ in. long, rough outside; seeds red or brown. Feb.–April. Australia. B.R. 3:186.

AAA. *Fls. white, greenish white or yellowish white.*

B. *Lvs. acute or acuminate.*

7. **rhombifòlium**, A. Cunn. QUEENSLAND PITTOSPORUM. Tree, 60–80 ft., or when grown as a pot shrub 4–5 ft. high: lvs. rhomboid-oval, coarsely and irregularly toothed from the middle up; veins prominent on both sides: fls. in a corymb resembling that of a Cornus; sepals obtuse; petals and capsule ¼ in. long: seeds 2–3, black. Queensland.—Franceschi says that the handsome yellow berries persist all winter in S. Calif.

8. **undulàtum**, Vent. MOCK ORANGE. Fig. 1836. With us a shrub or small tree: lvs. oval-oblong to lanceolate, entire, flat or undulate, rich deep green, margins often undulate, veins inconspicuous: inflorescence not corymbose: fls. intensely fragrant at night; sepals acuminate; petals 5–6 lines long: capsule ½ in. long; seeds numerous, light brown. Spring. Australia. B.R. 1:16.

1836. Pittosporum undulatum (× ⅓).

9. **tetraspérmum**, Wight & Arn. MADRAS PITTOSPORUM. Lvs. elliptic-oblong, acute, margins slightly waved and recurved: peduncles 1–2-fld., pubescent: fls. yellowish; sepals minute, pubescent, lanceolate, acuminate; petals linear: capsule 4-seeded. Feb., Mar. India.—Int. by Franceschi, 1897, who says it has very rich foliage. silky white in the new growth.

1837. Pittosporum Tobira, var. variegatum (× ⅔).

BB. *Lvs. very obtuse or retuse.*

10. **Tobira**, Dryand. TOBIRA. JAPANESE PITTOSPORUM. Winter-flowering shrub: lvs. obovate, glabrous, dark green above, pale beneath: fls. in a terminal sessile umbel, pure white, fragrant. China and Japan. Withstands some frost. Var. **variegàtum**, Hort. (Fig. 1837), has lvs. variegated with white.—In the East this variety is the favorite Pittosporum, as it makes a good house plant. The typical form is also cult. in Fla.

J. BURTT DAVY.

PIXY or **Flowering Moss** is *Pyxidanthera barbulata*.

PLÀCEA (possibly derived from a Chilean name). *Amaryllidàceæ.* Five species of rare and beautiful Chilean bulbs, of difficult culture bearing showy fls. something like an Amaryllis (Hippeastrum), the colors being white or yellow, streaked with red. Botanically the peculiar feature of Placea is its cup or corona, which is smaller than that of Narcissus and red, instead of yellow or white. The beauty of the Placeas, however, is of the Hippeastrum type, though the fls. are not so symmetrical, for at first sight it looks as if two of the perianth-segments were torn away. Placeas are generally classed as autumn-flowering bulbs. Though natives of the Andes at considerable elevations they are not hardy. The bulbs are said to lie deep in the ground in their native country, and pot culture is generally considered unsuitable for deep-lying bulbs. There is probably nothing in the genus finer than *P. ornata* as depicted in The Garden, with its umbel of 4 fls. each 3 in. across, and painted with red on a white ground, while each perianth has a strong green stripe up the middle. Yet Lemaire declares that his *P. grandiflora* has much larger flowers, the other parts of the plant being three times as large as in *P. ornata*. *P. ornata* was the first species discovered, but Miers, who found it in 1824, lost all his bulbs by shipwreck, together with the greater part of his collections.

"Placea," says Max Leichtlin, in Gn. 54, p. 510, "is one of those bulbs which will not be pot-bound. I either plant them in a walled frame which is kept free of frost, or in a low house which has a border on the south side, and is kept at 37° or 40° F. at night, and leave them alone. They go to rest about August and push up about December, flowering in May. In a pot they ought to have their exact time of rest, and must be buried in the soil, which ought to be very rich, but in pots they are not certain to flower. They must be planted with at least an inch of soil over their necks, and they prefer a loose soil. I use thoroughly decomposed cow manure (three and four years old), mixed during decomposition with one-third silver sand."

Generic characters: perianth funnel-shaped, with scarcely any tube; corona funnel-shaped, inserted at the base of the segments, deeply cut, the divisions notched, stamens inserted inside the corona: ovary top-shaped, 3-celled; ovules many, superposed: style declinate: stigma capitate, obscurely 3-lobed.

ornàta, Miers. Bulb 1 in. thick: lvs. 2, linear, appearing with the fls.: scape 6–9 in. high: umbel 4–6-fld.: perianth-segments 1–1¼ in. long. B.R. 27:50. Gn. 54:1202.

P. grandiflòra, Lem., is thrice as big as P. ornata, more floriferous, and is essentially distinguished by its perianth-segments, which are more acuminate and sharp-pointed. I.H. 15:574. F.S. 20:2047 (erroneously as P. ornata). W. M.

PLAGIANTHUS (Greek, *oblique flower*). *Malvàceæ.* About 11 species of tender shrubs and herbs from Australia, New Zealand and Van Dieman's Land, with large or small white 5-petaled flowers. They are hardy in the most favored parts of England. The finest species is *P. Lyalli*, which, however, is not easily prop. by cuttings. This species is grown as a pot plant or for cutting. The house treatment given Daphne will suit it well. None of the species is offered in America. They are known as "Ribbon Trees."

Generic characters: Bractlets none or distant from the calyx: calyx 5-toothed or cut; column of stamens divided at the apex into many filaments: cells of ovary 2–5, rarely 1 or many: ovules solitary, pendulous; carpels in a single series: style-branches longitudinally stigmatose within. Foliage and inflorescence various. Distinguished from Abutilon by the number of ovules.

A. *Fls. large, 1–1¼ in. across.*

Lýalli, Hook. Small branching tree, 20–30 ft. high: lvs. 2–4 in. long, cordate-ovate, doubly crenate, pale or white beneath; petiole 1–1½ in. long: fls. 1–1¼ in. across, numerous, drooping, in axillary clusters of 3–5; styles pink; calyx campanulate. July. B.M. 5935. Gn. 44:917. G.C. III. 4:209.—Said to be evergreen below 3,000 ft. in New Zealand, deciduous above.

AA. *Fls. small, ½ in. across or less.*

Lámpenii, Booth. Botanically only a variety of *P. pulchellus*, but horticulturally incomparably superior. Shrub, attaining 6–8 ft.: lvs. oblong-lanceolate, 4–5 × ½–1 in., sharply serrate: fls. in short, axillary leafy panicles, very numerous and crowded; styles very small. Van Dieman's Land. G.C. II. 22:201.

pulchéllus, Gray (*Abùtilon pulchéllum*, Sweet. *A. púlchrum*, Don). Tall shrub: lvs. lanceolate, cordate, acuminate, 2–3 in. long, coarsely crenate: fls. few, clustered along rachis of axillary racemes: ovary 5-celled. Australia. B.M. 2753 (*Sida pulchella*).

H. A. SIEBRECHT and W. M.

PLAGIOBÒTHRYS (Greek, *plagios*, sideways, and *bothros*, pit or hollow; wherefore the name should have been written *Plagiobothrus*). *Borraginàceæ.* Nine species of low-growing, commonly diffuse annuals from western America, with small white fls. Here belongs *P. nothofúlvus*, Gray, which was once advertised by Breck under its synonym *Eritrichium nothofulvum*, Gray. This plant has no horticultural standing and is no longer advertised. See Gray's Syn. Flora of N. Amer.

PLÁNERA (after J. J. Planer (1743–1789), professor of medicine at Erfurt; author of several books on botany). *Urticàceæ.* WATER ELM. Monotypic genus, allied to Ulmus and Celtis: lvs. pinnately veined, alternate: fls. polygamous, with deeply 4–5-lobed calyx; staminate fls. short-stalked, in clusters at the base of the young branchlets, with 4–5 stamens; pistillate or perfect ones on rather slender stalks, 1–3 in the axils of the lower lvs.: fr. a small muricate nut. The only species is **P. aquática**, Gmel. (*Anónymus aquáticus*, Walt. *P. ulmifòlia*, Michx.). Small tree, sometimes to 40 ft.: lvs. short-petioled, somewhat unequal at the base, ovate to ovate-oblong, unequally serrate, glabrous at length and somewhat leathery, 1⅓–2⅓ in. long: fr. oval, ⅓ in. long, with irregularly crested fleshy ribs. April, May. S. Ill. and Ky. to Fla. and Tex. S.S. 7:316. This tree is not in general cultivation and has little to recommend it as an ornamental plant. It would not prove hardy north. It will probably thrive best in moist soil and be prop. by seeds sown soon after ripening in May and by layers. The plants sometimes cult. under the name of *P. aquatica* belong either to *Ulmus campestris*, var. *viminalis*, *U. Chinensis*, or *U. alata*, to which the true Planera is similar in foliage, or to some other small-leaved elm.

P. acuminàta, Lindl.=Zelkowa Keaki.—*P. carpinifòlia*, Wats. =Zelkowa carpinifolia.—*P. Japónica*, var. *Verschaffelti*, Hort. =Zelkowa Japonica, var. Verschaffelti.—*P. Keaki*, C. Koch= Zelkowa Keaki.—*P. rèpens*, Hort.=Ulmus pumila or Chinensis. —*P. Richardi*, Michx.=Zelkowa carpinifolia.

ALFRED REHDER.

PLANE-TREE. See *Platanus.*

PLANER-TREE. *Planera.*

PLANT (Latin, *planta*). A plant is a living organism consisting of one or more cells, some of which, in most of the higher forms, contain a green substance—*chlorophyll*—by the aid of which they are able in the light to construct carbohydrate food-matters (as sugar, starch, etc.) from carbon dioxid and water. The cell protoplasm assimilates or uses these carbohydrates and is nourished by them, and from the elements they furnish it is able to make *cellulose*, the substance which walls it in, and gives strength and solidity to the plant. Animals do not (as a rule, at least) have chlorophyll, and cannot construct carbohydrates from carbon dioxid and water. Some plants have the habit of absorbing their carbohydrates ready-made from other organisms, and they are destitute of chlorophyll, as in case of the fungi, lichens, bacteria, and some flowering plants (e. g., dodder, Indian pipe, beech drops, etc.). Such plants are more or less degenerated, and are physiologically like animals, but they still retain enough of the typical plant structure so that we are rarely at a loss where to place them. Green plants absorb carbon dioxid from the air, and in the process of carbohydrate formation they give off a certain quantity of oxygen. However, in the further chemical activities of their cells oxygen is absorbed and carbon dioxid is given off. In the plants which are not green (and in animals, also) the first process is wanting, while the second takes place. These facts have given rise to the view that plants and animals are quite opposite in their physiological relations to the surrounding air. They should not be contrasted, however, in this way; it is more exact to say that green plants have two important nutritive functions, namely (1) carbon absorption and fixation (technically, *photosynthesis*), and (2) the assimilation of food matters. Respiration—in the process of which oxygen is absorbed and carbon dioxid is given off—occurs in all plants and animals.

C. E. BESSEY.

PLANTÀGO (the Latin name) comprises some 200 or more species of annual or perennial herbs or subshrubs occurring in many parts of the world. It is a weedy genus, and only two or three species have any economic or commercial value worth mentioning. They are generally known as Plantains, although this name is also applied to certain bananas (see *Musa*), which are plants of widely different kind. *Plantago lanceolata*, or Ribwort, is sometimes used in pasture mixtures abroad, because it affords more or less spring pasturage on dry and sterile soils. The seed is offered by American seedsmen for feeding birds, but not for sowing. In this country, however, it is one of the vilest of lawn weeds, thriving in our hot, dry soils when grass kills out. The only remedy for it is to secure a better stand of grass, and this is made possible by making the ground rich and so treating it that it will hold moisture. *Plantago Coronopus*, the Bucks-horn Plantain, native to Europe, Asia and North Africa, is sometimes eaten as a pot-herb (see p. 697). It is a low perennial, with linear-lanceolate often pinnatifid leaves. It is not in the American trade. *P. cordata*, of the eastern United States, is offered by one or two dealers in native plants as a subject for colonizing in bogs and margins of ponds. It is perennial, with a stout rootstock, large cordate-orbicular shining leaf-blades, and a slender spike rising 1-2 ft. high and bearing small pinkish flowers with exserted style and stamens. *P. major* (Fig. 1838) is a very common dooryard weed. There are about 20 native or naturalized species in North America. Plantago is the typical genus of the *Plantaginaceæ*, a family that contains two other genera, both monotypic.—Littorella in Europe and northern North America, and Bougueria in the Andes of Peru and Chile. L. H. B.

PLANTAIN. See *Plantago* and *Musa*.

PLANTAIN LILY. *Funkia*.

PLANTAIN, RATTLESNAKE. *Hieracium venosum*.

PLANTAIN, WILD. *Heliconia Bihai*.

1838. Spike of Plantago major — common Plantain. Nat. size.

PLANT-BREEDING. Practical agriculturists the world over have long recognized that animals can be greatly improved by intelligent breeding, but it is only within the last century that it has come to be recognized that plants can be improved in the same way. Even yet some of the fundamental principles of plant-breeding are not generally understood and require to be demonstrated experimentally. Within recent years, however, general interest has been awakened in the subject, particularly in this country, and doubtless results of the greatest interest will soon be attained.

Practical plant-breeding may be said to have begun with the work of Thomas Andrew Knight and Jean Baptiste Van Mons in the early part of the nineteenth century. Knight was the first to show the practical value of hybridization in the production of new sorts and races. As early as 1806 he wrote: "New varieties of every species of fruit will generally be better obtained by introducing the farina of one variety of fruit into the blossoms of another than by propagating from a single kind." The other most important factor of plant-breeding, that of selection, was first established by Van Mons, a Belgian horticulturist who worked mainly with pears. (See Essay 5, "Survival of the Unlike," Bailey.) Since this time many investigators have given time and thought to the ways in which plants may be improved, until at present we have established a fairly definite system which may be followed, with slight variation, in the amelioration and improvement of any plant.

The plant-breeder must first of all recognize that a thorough knowledge of the plant he desires to improve is of primary importance. The time for haphazard experimenting has long since gone by, and the experimenter may simply waste his time if his efforts are not well directed. If it is apples or wheat that he desires to improve, all of the varieties of apples and wheat should be studied and their qualities recognized. The experimenter should always have in view a definite improvement which he wishes to obtain, and the varieties which exhibit this feature in the highest degree should be selected for the work. If working from the utilitarian standpoint, the desirability of having a definite aim in view can hardly be overestimated, as it is only in this way that the breeder can be guided in his selection of the parent stock or stocks.

Systematic plant-breeding includes two processes largely distinct in their nature: (1) The production of variations, and (2) the fixation and augmentation of desirable variations by methodical selection.

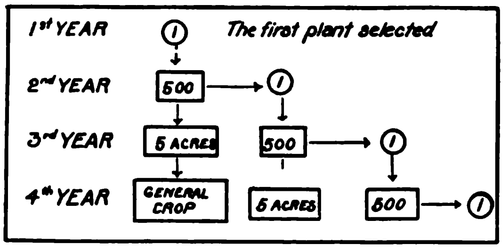
In order to improve a plant it must be induced to vary in the required direction. If this variation is brought about by some environmental change the same conditions are maintained through another generation, and the plants showing the greatest variation in the required direction are again selected, thus gradually leading to a progressive improvement in the character desired. If the variation is produced by hybridization it must be fixed and rendered hereditary by a similar process of selection. Thus, whether breeding by selection alone or by hybridization, these two factors of breeding enter into the process.

VARIATIONS, HOW PRODUCED.—In general, plants reproduce their main characters unchanged. The stability of the races of our cultivated plants and natural species depends upon this law of heredity, which has been expressed in the aphorism "like produces like." Plants, however, are not fixed and stable beings, but are eminently plastic and variable. Every individual differs from every other individual in some way, just as every individual animal differs from every other individual of the same race. These individual variations which enable us to recognize one plant from another, or one animal from another, and which are inherent in the being itself and not, so far as can be determined, dependent upon environment, are what Darwin termed "indefinite variations," and are now generally known as "congenital variations." If we examine a row of nursery trees of apple or peach we find that every individual may be clearly recognized by some distinctive character. Some trees grow erect and columnar, some low and spreading, some branch low, some high, some have large leaves, some small leaves, and by a careful examination numerous other distinguishing characters can be found. It is on these individual variations that the improvement of plants by selection mainly depends.

It has been found by breeders of both plants and animals that individuals vary greatly in the power of transmitting their characters to their offspring, and this is one of the most important factors in plant-breeding. As an illustration, ten individual cotton plants may be selected which produce an exceptionally long lint of comparatively the same character. If the seeds from each of these ten select plants are planted separately it will be found that the ten plants vary greatly in their ability to transmit this character of producing long lint to their offspring. The entire progeny of one plant may revert and produce a much shorter staple than the parent form. On the other hand, one of the original ten plants may have the power of inheritance strongly developed and transmit to the great majority of its progeny the quality of producing long lint. It is to the progeny, then, of this individual that the breeder must look in order to fix a new race of long-staple cotton. The strength of the hereditary tendency is thus of the greatest importance to the breeder.

Another form of variation probably important to the plant-breeder is that caused as a direct result of environment and termed by Darwin definite variation, because all plants subject to the same environment tend to vary in the same direction. As an illustration, plants removed from a low altitude to a high altitude become dwarfed in stature and the flowers become larger and usually brighter colored. Transferring the plant to the seacoast and growing it under maritime conditions usually results in the leaves becoming thicker and the whole plant more succulent. If such plants are transferred back to the interior, away from all effects of the sea, the next year they usually, if not always, revert entirely to their original characters. If, however, they are grown in a maritime region for several generations and the seed is selected every year from the most succulent individuals, it is believed that a succulent sort may be originated more quickly than in any other way.

How valuable this factor of environment is in the origination of newly cultivated sorts yet remains to be demonstrated scientifically, but some practical plant-breeders contend that it is a factor of very great importance.

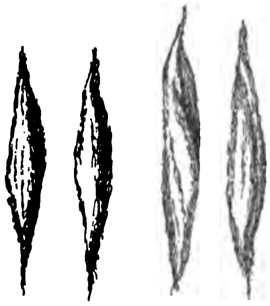


1839. Diagram illustrating method of selecting cotton.

Occasionally individuals "sport," as gardeners say, and plants entirely different from the type of the race are produced. These variations are usually very marked ones and no definite cause for their appearance is yet known. Many valuable races of cultivated plants owe their origin to variation of this sort. For instance, the Cupid type of the sweet pea, a dwarf race, originated as a seedling sport from the Emily Henderson, an ordinary tall sort, and certain other sweet peas, the writer is informed, show a tendency to sport in this way. Another variation of similar kind is the change in character of certain parts or branches of individuals, known as bud-sporting. Bud-sports have proved particularly valuable in producing new sorts of chrysanthemum and other plants cultivated for their flowers. There appears to be no way in which the breeder can induce seedling- or bud-sports, and the only course seems to be to watch carefully for their occurrence and be ready to utilize them whenever they appear.

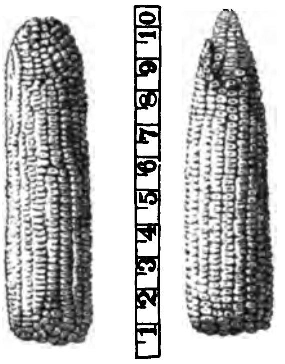
The most fertile way of securing variations is by the intermingling of species and varieties by hybridization. By blending distinct types of different species or races in this way, individuals of almost any grade of intermediacy between the two parents can be obtained and those having valuable combinations of characters selected and sometimes fixed into stable races. Crossing in general is probably the most active agency in procuring variation, and is thus of the highest importance to the plant-breeder, inasmuch as the production of the initial variation of a desired kind and in a desired direction is the most difficult achievement.

IMPROVEMENT BY SELECTION.—Improvement by selection depends upon the principle of gradually augmenting a quality by selecting seed each year from that individual which by comparison with numerous other individuals is found to exhibit the character desired in the greatest perfection or highest degree. By this constant selection of seed from the best individual, it has been found that the desired quality can be secured in more and more marked degree the longer the selection is continued. It is to this cumulative power of selection that the great improvement in many of our cultivated plants is due, and, in general, selection may be considered a fundamental factor in the successful cultivation of any crop, as it is necessary not only to improve a race but to retain it true to type and in vigorous productive condition.



1840. Improvement of Sea Island Cotton by selection.
Ordinary type on left, and selected type on right.

The most marked instance known to the writer of the improvement of a plant by selection alone and the dependence of an entire industry on this factor, is that of the sea island cotton. Every successful grower of sea island cotton selects his seed each year with the greatest care, and pursues year after year a definite process of continuous selection. In beginning selection, the general crop is examined and a number of individuals selected which seem from general appearance, vigor, productiveness, etc., to be superior plants. These superior plants are then subjected to a very critical examination as to (1) vigor, (2) productiveness, (3) season, (4) covering and size of seed, (5) character of staple, etc. Under the last heading, "character of staple," attention is given to (*a*) length, (*b*) strength, (*c*) silkiness, (*d*) fineness, (*e*) uniformity of length and (*f*) proportion of lint to seed, etc. Finally, considering all of the above points carefully, the individual which is found to be superior to all others is selected. The seed from this is saved and planted the next year in a select patch and will usually yield some 500 individuals.



1841. Improvement of corn by selection.
Boone County White corn on left, and original type from which it was developed by selection on right.

The second year a single superior plant is selected with the same care from among the 500 plants grown from the seed of the plant selected the first year. The seed of the remaining individuals of the 500 plants is retained to plant a special seed patch the third year.

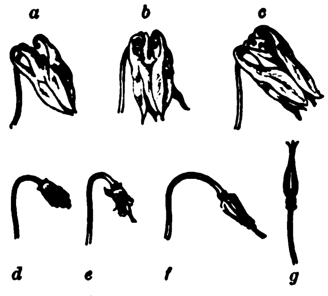
The third year the seed of the specially selected plant of the preceding year is grown by itself, producing some 500 plants, from among which a single superior individual is again selected. The seed of the remaining 500 plants is again retained to plant a special seed patch the fourth year. Further than this, in the third year the seed of the 500 plants grown the previous year is planted by itself and will produce a patch of some 5 acres in extent, which will yield sufficient seed to plant the general crop in the fourth year of the selection. (Compare Fig. 1839.) In succeeding years this policy is continued, the general crop being grown continuously from seed of a higher and higher grade of selection. Under this continuous selection the quality and length of the staple has been continuously improved (Fig. 1840), and the yield increased, so that the growers to-day are producing more cotton than ever before and of a better quality. Corn (Fig. 1841), wheat, and very many of our races of other cultivated plants have been improved in a similar manner, and many of our most valuable races to-day are simply types gradually ameliorated through years of continuous selection.

In a similar manner selection may be used to improve any character of a plant, as the shape or color of a flower, acidity of the fruit, sugar content of the root (as in the beet), protein content of the seed (as in corn and wheat), etc. The necessity of intelligent selection of plants from which seed is to be taken can hardly be overestimated.

In all of our orchard fruits selection has played a most important part, though here the process is slightly different, as the selection is usually limited to a single generation, the best individual among many seedlings being selected and propagated by buds or grafts so that further selection to fix and retain its qualities are unnecessary. In this way was produced the famous Concord grape, the Dana Hovey pear, the Wealthy apple, etc. It must not be understood, however, that continuous selection would not give valuable results among orchard fruits also. Some of our good select seedling varieties are seedlings of select seedlings, and the process is thus a continuous one, though carried on largely by different experimenters owing to the long time required to secure fruits.

The character of the individual as a whole is a factor of prime importance in selection, and should be clearly recognized by every one striving for improved or pedigree plants. The aim should not be to select the single best fruit, but to select fruit from the best individual plant. If one is selecting to decrease the number of seed he would probably entirely fail should he depend upon examining a number of fruits without reference to the plants on which they grew, and selecting that one for propagation which was found to contain the fewest seed. He should examine the fruit on numerous trees, and then take seed for planting from that tree which by the examination of many fruits is found to show the most decided general tendency toward seedlessness.

Limitations of Selection.—Selection is by many horticulturists considered to have been the most important factor in the development of our cultivated plants, and some go so far as to assert that all other factors are of minor importance. Both crossing and selection, however, have their definite and distinct places in any rational system of plant-breeding. When used alone in the improvement of plants, selection depends upon the adding up of small, insignificant variations through many generations, which in the end may possibly result in marvelous differences; but by this method the breeder has no way to force the change, and must be satisfied with slight variation and long-continued selection. When marked changes and new creations are desired it is to crossing or to chance sports that attention must be directed.



1842. Aquilegia flowers, illustrating the process of emasculation.

a, mature bud showing stage which should be selected for emasculation; *b*, similar bud with the tips of the corolla pried apart and the stamens removed; *c*, a bud opened naturally, too old to operate on; *d*, a bud of the stage shown in *a* and *b*, with corolla removed to show the internal organs; *e*, a bud the same as in *d*, but with the stamens removed; *f*, the same as *e*, but older, at the age when pollination normally takes place; *g*, pistil shortly after fecundation, the remnants of the stamens having fallen away.

IMPROVEMENT BY MEANS OF CROSSING.—Aside from selection, crossing has played the most important role in the formation of the varieties and races of our cultivated plants, but the results obtained are in many cases closely connected with selection. In the production of new and novel races it is to the crossing of markedly different species or races that the breeder must look. In this way plants may be obtained combining the good qualities of two distinct sorts, with an elimination of the undesirable features. In plants which are propagated by vegetative parts, such as buds, grafts, cuttings, etc., a desirable variation obtained by crossing may be propagated directly without further improvement. This is the case in apples, pears, oranges, and all orchard fruits. In the case of plants propagated by seed, however, a valuable hybrid must be inbred and selected for several generations until a fixed type is produced.

The process of crossing or hybridizing plants is neither difficult nor mysterious. It is simply necessary to recognize that plants, like animals, bear male and female organs. In plants, however, the male and female elements are most commonly borne on the same individual and in the same flower. In some cases, as in the castor bean, corn, etc., both sexes are borne on the same plant but in different flowers, while in other cases, as in the date palm, hemp, box elder, etc., the sexes are on different plants.

1843. Plant of Aquilegia with flowers covered with bags in hybridization work.

If the plant to be operated on has the stamens and pistils (male and female organs) in the same flower, buds must be selected and the stamens removed before they burst and discharge the pollen. This is necessary in order to prevent self-fertilization. In some instances, as in the case of the columbine, this can be done very easily by simply selecting a bud just before it opens (Fig. 1842) and prying the tips of the petals apart so that the stamens may be pulled off with small pincers or forceps. The bud should then be inclosed in a small paper bag until the pistil matures normally, when the bag may be removed and the pollen dusted over the pistil (female organ). After this the bag must again be put over the flower to prevent other pollen from being brought in by insects, etc. Fig. 1843. In some cases the pollen may be placed on the immature pistil without injury when the flower is emasculated, and this is a great saving of time when it can be done. However, in experiments conducted by C. P. Hartley, of the U. S. Department of Agriculture, it has been demonstrated that in some plants the pollination of immature pistils produces injury and thus cannot be practiced in all cases.

In some instances, as in the apple, pear, cotton, etc., it is difficult to pry the petals apart to remove the stamens, and in such cases the corolla may be cut off without injury, in this way exposing the organs so that the stamens can be easily removed (Fig. 1844).

In striving to secure a certain combination of the good characters of any two sorts, very numerous crosses between them should be made in order to furnish the breeder greater range of selection. Indeed at every step the success of the plant-breeder depends on handling large numbers. True, the desired variation may be secured in a small batch of crosses, but the chance of success is increased in proportion to the number handled. In his experiments Burbank has found that in peaches about one desirable variety of superior excellence is obtained from each 1,000 seedlings tested, while in raspberries and blackberries only about one sort in 20,000 has proved to be worthy of retention.

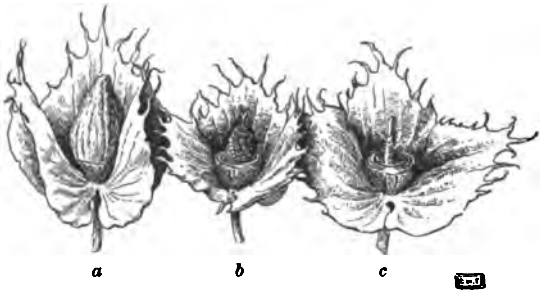
In the crossing of races and species the hybrids in the first generation are usually nearly alike, exhibiting in general the same intermediate characters. In the second generation of these hybrids, however, there is almost invariably greater variation, and it is usually from the plants of this generation that the most valuable types can be selected. It is thus important that the hybrids of the first generation should be inbred with their own pollen or with pollen of the hybrids of the same combination, and numerous individuals of the second generation obtained in which plants showing the desired combination of characters are more likely to be found.

One of the most prominent characters of crosses is their extreme vigor, which is particularly marked in racial and specific hybrids where the parents are widely distinct in characters (Fig. 1845). In crosses of closely related sorts, which are reproduced by buds, cuttings, slips, etc., and which do not ordinarily remain true to type when propagated by seed, the increase in vigor is not commonly so marked.

Sterility, which is a common character of hybrids of very distinct species and races, may prove a detriment in certain cases; but it is seldom that all of the hybrids of any combination are completely sterile, and in most instances of this sort complete fertility can probably be secured by selection.

The improvements which can be secured by means of crossing are almost innumerable, and many of them, so far as we are informed, can be secured in no other way. Such is the production of fragrant varieties from odorless types as has been accomplished in the case of pansies, and the blending and changing of colors of flowers and fruits. Increased hardiness and adaptability to growth in warmer climates might possibly be secured by simple selection through a long series of years; but they can doubtless be most quickly secured by crossing tender and hardy sorts or species, when plants can be obtained which possess these opposite qualities.

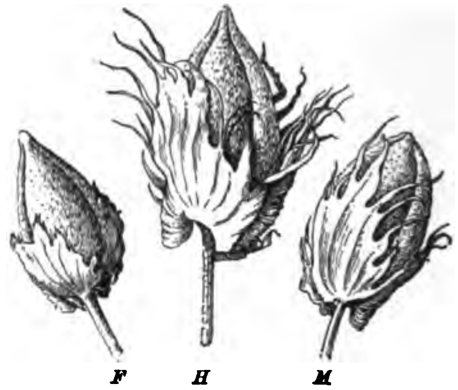
Fixation of Crosses.—In plants which are propagated by vegetative parts no fixation is necessary, but in those which are propagated by seed, all crosses that are found to possess desirable qualities must be fixed by selection into stable races reproducing these qualities true. Usually, a large majority of the progeny of a cross will revert toward one of the parents, and may not show the characters desired. In order to render the desired qualities hereditary, the cross must be inbred with its own pollen or the pollen of another cross of the same parentage which exhibits the same characters, and a large number of plants grown from the seed thus produced. These plants must then be carefully examined and individuals selected for further work which have reproduced the desired characters in the highest degree. These individuals must be again inbred and the process continued for several generations until all of the plants are reproduced true to the desired type. This, in most cases, requires from five to six generations of careful selection. The time used in selecting to fix the type is by no means lost, as meanwhile careful attention can be given to increasing the fruitfulness so that this factor also may be greatly improved.



1844. Cotton flowers, illustrating the process of emasculation.

a, mature bud showing the stage which should be selected for emasculation; *b*, a similar bud with the corolla cut off ready to emasculate; *c*, a similar bud with the stamens removed,—emasculated.

THE SELECTION OF VEGETATIVE PARTS.—Within recent years some attention has been given to the improvement of plants by the selection of buds, cuttings, etc., and the results obtained by certain practical investigators indicate that much may be accomplished in this way. In orchard fruits, carnations, violets, potatoes, etc., careful attention should thus be given to the buds or cuttings used in propagation. By a careful selection of violet cuttings from those plants which were found to produce the greatest number of good flowers, P. H. Dorsett has greatly increased the average yield of his plants and believes that an increased yield of nearly 100 per cent is perfectly possible by careful attention to this factor alone. Here, again, it is not increased yield merely which can be improved, but various other qualities as well.



1845. Increase in size of cotton bolls caused by hybridization.

F, Sea island cotton used as the female parent; *H*, hybrid; *M*, Klondike, a variety of upland cotton used as the male parent.

The literature of plant-breeding is mainly scattered through periodicals and is difficult of access. The principal work treating the subject in a general way is Professor Bailey's "Plant-Breeding" (The Macmillan Company, New York, 1895). The following are a few of the most important general papers: "The Production et Fixation des variétés dans les végétaux," by E. A. Carrière, Paris, 1865; "Die Pflanzenmischlinge," by W. O. Focke, Berlin, 1881; "A Selection from the Physiological and Horticultural Papers of Thomas Andrew Knight, published in the Transactions of the Royal and Horticultural Societies," London, 1841; "Hybrids and their Utilization in Plant-Breeding," by W. T. Swingle and H. J. Webber; Year-book, U. S. Department of Agriculture, 1897; "Sur la Production et la Fixation des Varietes dans les Plantes d'Ornement," by Jean Baptiste Verlot, Paris, 1865; "The Improvement of Plants by Selection," Yearbook, U. S. Department of Agriculture, 1898; "Hybrid Conference Report," Journal Roy. Hort. Society, vol. xxiv, April, 1900; "Survival of the Unlike," by Bailey.

HERBERT J. WEBBER.

PLANT CELLARS will be treated under *Winter Protection*.

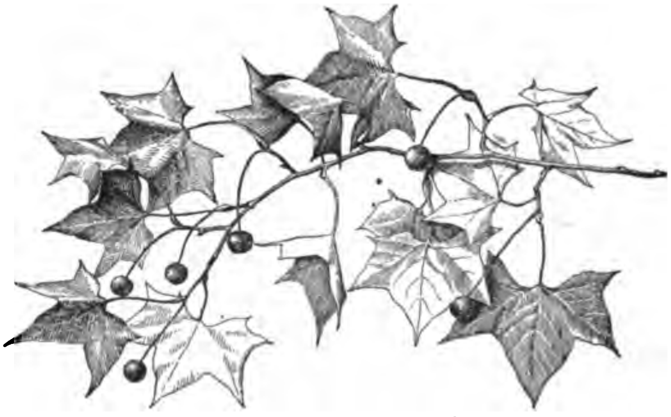
PLÁTANUS (its ancient Greek name). *Platanàceæ*. PLANE-TREE. BUTTONWOOD. Ornamental deciduous trees with alternate, petioled, rather large, palmately lobed lvs. and small greenish flowers in globular, solitary or racemose, slender-stalked and drooping heads, followed by similar heads of fruits remaining on the branches during the winter. The smooth, light-colored often almost creamy white bark of the branches and limbs, usually mottled by darker blotches of the older bark, which peels off in large thin plates, gives the tree a very characteristic appearance in winter, while in summer the Plane-tree, with its large head of dense bright green foliage and with its massive trunk, is a beautiful and majestic shade tree. The native *Platanus occidentalis* is hardy north and *P. orientalis* hardy as far north as Mass., while the southwestern and Mexican species cannot be cult. in the North. From time immemorial the Oriental Plane, which was well known to the ancient Greek writers, has been famous for the large size it attains—trunks of 30 ft. diameter and more are reported to exist—and has been planted as a shade tree in W. Asia and S. Europe, and to-day it is still one of the favorite street trees throughout the temperate regions of Europe. It has also been recognized in this country as one of the best street trees, even to be preferred to the native Plane, which, unfortunately, suffers from the attacks of a fungus, *Glœosporium nervisequum*, while the Oriental is not injured by it. The Plane-trees stand pruning—even severe pruning—well. To what extent they are sometimes pruned in European cities without losing their vitality is shown in an interesting illustration in "Forest Leaves," vol. 3, p. 97. They are also easily transplanted even as larger trees. They grow best in a deep and rich, moist soil. Prop. by seeds sown in spring and only slightly covered with soil and kept moist and shady; also by cuttings of ripened wood and by greenwood cuttings under glass in June taken with a heel and sometimes by layers. Varieties are also occasionally grafted in spring on seedlings of one of the species. The stellate hairs of the young lvs. when detached by the wind, sometimes float in great quantities in the air and are liable to cause irritation and sometimes inflammation of the mucous membranes of the eye, nose and mouth. But as this is likely to occur only during a very limited period late in spring it can hardly be considered as a serious objection to the use of Platanus as a street tree.

1846. Plane-tree—Platanus occidentalis.

Six or 7 species of Platanus are known in N. America south to Mexico and from southeast Europe to India. Trees with the bark exfoliating in thin plates; only at the base of older trunks the bark is persistent, of darker color and furrowed. Stipules conspicuous, usually connate into a tube, with spreading leaf-like margin; petiole with the enlarged base inclosing the axillary bud: lvs. palmately veined, covered densely with stellate hairs when young: fls. monœcious, in dense, globular heads, staminate and pistillate similar, but on separate peduncles; sepals and petals 3–8; staminate with 3–8 stamens, pistillate with 3–8 pistils with elongated styles: fr.-heads consisting of numerous narrowly obconical, one-seeded nutlets surrounded at the base by long hairs.

occidentàlis, Linn. BUTTONWOOD. BUTTONBALL. AMERICAN PLANE-TREE. Also wrongly called SYCAMORE. Figs. 1846, 1847. Large tree, attaining 130 or occasionally 170 ft., with a round-topped oblong or broad head and with a trunk 10 ft. or exceptionally more in diam., often of considerable height: bark of limb and branches of very light often almost creamy white color, at the base of the trunks dark brown, fissured: stipules large, with toothed margin: lvs. as broad or broader than long, truncate or cordate, rarely cuneate at the base, usually 3-, sometimes 5-lobed, with shallow sinuses; lobes shorter than broad, coarsely toothed or entire, floccose-tomentose when young, at maturity only pubescent on the veins beneath, 4–9 in. broad: fr.-heads solitary, rarely in 2's, on 3–6-in. long peduncles, about 1 in. across or more, comparatively smooth at length; nutlets with obtuse apex, with the rest of the style one-sixteenth inch long or shorter. May. Maine to Ontario and Minn., south to Fla. and Tex. S.S. 7:326, 327. G.F. 2:354, 355; 9:55. Em. 1:261, 263. Gng. 4:343. Mn. 3, p. 69; 5, p. 205, 209.—The most massive and perhaps the tallest of all deciduous trees of N. America and an excellent street and park tree where it is not injured by fungous diseases. There are several vars. in cultivation: Var. **Hispánica**, Janko (*P. Hispánica*, Lodd.). Lvs. large, 3–5-lobed, with very shallow sinuses, coarsely toothed, usually cordate at the base. Gn. 1, p. 588; 20, p. 370. Var. **pyramidàlis**, Jaen. (*P. pyramidàlis*, Bolle). Of pyramidal habit: lvs. usually 3-lobed, often longer than broad, with usually rounded base. Var. **tubìfera**, Jaen. (*P. supérba*, Hort.). With very conspicuous elongated, tubular stipules. There are also some forms with variegated lvs. Var. **Süttneri**, Hort., with the lvs. spotted and marked white, and var. **aureo-variegàta**, Hort. (var. *Kelseyàna*, Jaen.), with yellow variegated leaves.

orientàlis, Linn. ORIENTAL PLANE. Tree, to 80 ft., with usually very broad and round head on a comparatively short trunk: bark of dull grayish or greenish white color; stipules small, usually with entire margin: lvs. usually broadly cuneate at the base, deeply 5–7-lobed, rarely 3-lobed, with the sinuses reaching almost to or below the middle; lobes longer or much longer than broad, coarsely toothed or entire, glabrous or nearly so at maturity, 4–8 in. long: fr.-heads 2–4 on long, drooping stalks, bristly, the nutlets narrowed at the apex into a persistent style to 2 lines long. May. S. E. Eu. to India. G.F. 4:91. G.C. III. 23:25, 27. Gn. 1, p. 550; 20, p. 369, 371, 373.—A variable species, of which the most important forms are the following: Var. **acerifòlia**, Ait. (*P. acerifòlia*, Willd. *P. intermèdia*, Hort.). Lvs. less deeply lobed, the sinuses rarely reaching below the middle; lobes usually 5, the middle one only little longer than broad: fr.-heads usually in 2's. Gn. 1, p. 588; 20, p. 371 and probably 1, p. 486 and 20, p. 370 (as *P. occidentalis*). This form resembles in foliage the American Plane, and is also of more pyramidal habit than the Oriental Plane, which in its typical form has a broad head, with wide-spreading branches deeply divided, 5–7-lobed lvs., and the fr.-heads often in 3's and 4's. It is often considered a distinct species, and some have ventured the opinion that it may be a hybrid between *P. occidentalis* and *P. orientalis*, as it is in some characters intermediate between the two, but the fr. does not differ from that of the latter. The var. *acerifòlia*, which is the so-called London Plane, seems hardier and is more generally planted under the name of the Oriental Plane than the typical *P. orientalis*. Var. **digitàta**, Janko (*P. umbraculifera*, Hort., var. *la-*


1847. Platanus occidentalis (× ¼).

cinidta, Hort.). Lvs. cuneate or truncate or cuneate at the base, deeply 5-lobed, with narrow, elongated, coarsely toothed lobes. Gn. 1, p. 572, 573; 20, p. 371. Var. **undulàta,** Ait. (var. *cuneàta*, Loud. *P. cuneàta*, Willd.). Often shrubby: lvs. short-stalked, smaller, usually deeply 3-lobed and cuneate, with narrow-toothed lobes. Gn. 1, p. 618; 20, p. 371.

P. racemòsa, Nutt. (P. Californica, Benth.). Tree, to 100 or 120 ft., with a trunk often divided into several stems: lvs. usually cordate or truncate, deeply 3–5-lobed, with ovate-lanceolate, mostly entire lobes, pale-tomentose beneath, 6–10 in. long: fr.-heads bristly, sessile on the slender stalk, racemose. Calif. S.S. 7:328.—*P. vulgàris*, Spach, comprises all species of the genus.—*P. Wrightii*, Wats. Tree, to 80 ft., often divided into several stems: lvs. usually cordate or truncate, deeply 3–7-lobed, with lanceolate, acuminate, entire or dentate lobes, tomentose beneath or nearly glabrous at length, 6–8 in. long: fr.-heads racemose, rather smooth, each on a short stalk. New Mex. and Ariz. to Calif. S.S. 7:329.

The other species, as *P. Mexicàna*, Moric., which is sometimes planted as a street tree in Mexico, *P. Lindeniàna*, Mart. & Gal., and *P. glabràta*, Fernald, all natives of Mex., are not yet introduced.

ALFRED REHDER.

PLATYCÀRYA (*platys*, broad, *carya*, nut; alluding to the shape of the fruit). Syn., *Fortùnea*. *Juglandàceæ*. A monotypic genus distinguished from all other Juglandaceæ by its fertile fls. forming an upright cone-like spike. Small deciduous tree: the branches with solid pith: winter-buds with imbricate scales: lvs. odd-pinnate, similar to those of *Hicoria Pecan*, but smaller; staminate catkins axillary; pistillate terminal, solitary: fr. a small, winged nut in the axils of densely imbricated, rigid and sharply pointed lanceolate bracts forming a terminal upright cone. Rarely cult. and probably not hardy north of the Middle States. It has graceful and interesting foliage, but its ornamental value is not great. Prop. by seeds and by layers, probably also by grafting on Hicoria.

strobilàcea, Sieb. and Zucc. (*Fortùnea Sinénsis*, Lindl.). Small tree, with upright glabrous branches: lvs. 8–12 in. long; lfts. 9–17, sessile, oblong-lanceolate, falcate, acuminate, doubly serrate, pubescent only on the midrib beneath, 3–4 in. long: fr.-bearing cone about 1–1⅓ in. long, oval, brown. Summer. Japan, China. S.Z. 2:149. F.S. 4, p. 326b. R.H. 1888, p. 88.

ALFRED REHDER.

PLATYCÈRIUM (Greek, *broad horn;* alluding to the shape of the lvs.). *Polypodiàceæ*. STAG-HORN FERN. An anomalous genus of ferns with irregularly lobed thick lvs. with the sori forming irregular patches over one or both surfaces. The sterile lvs. are flat, rounded expansions closely adherent in layers to the substratum. In their native forests these ferns grow to the surface of trees and old plants and often form enormous nests.

Eight kinds of Platycerium are offered for sale in America. The word "disk,' as used below, refers to the widest unbranched portion of the fertile frond.

A. *Plants not forked like a stag horn*...1. **Angolense**
AA. *Plants resembling a stag horn.*
  B. *Sori borne on a special receptacle described under No. 2*..........2. **biforme**
  BB. *Sori borne on the last forks or near their base.*
    C. *Barren fronds stag-horn-like above.*
      D. *Fertile fronds in pairs.*
        E. *Plants glabrous or nearly so*........................3. **grande**
        EE. *Plants pubescent, with yellowish wool*...............4. **Wallichii**
      DD. *Fertile fronds in 3's*.........5. **Willinckii**
    CC. *Barren fronds not stag-horn-like, entire or merely lobed.*
      D. *Segments and sinuses of the fertile fronds very broad*...6. **Æthiopicum**
      DD. *Segments and sinuses narrow.*
        E. *Unbranched portion of fertile fronds very long and narrow*..................7. **Hillii**
        EE. *Unbranched portion of fertile fronds moderately long*......................8. **alcicorne**

1. **Angolénse,** Welw. (*P. Æthiópicum*, var. *Angolénse*, Welw.). Fertile fronds wedge-shaped in outline and merely wavy at the margin. It is also distinct by reason of felt-like covering of rust-colored wool on the lower side of the fronds. Barren fronds large, erect; fertile fronds attaining a length of 18 in. and a width of 9 in. at the top: spore-mass nearly as broad as the frond. Angola (West Africa). G.C. III. 23:155 (repeated in 28:444).

2. **bifórme,** Blume. According to Blume's plate and description, this differs from all other kinds in having the spores borne on a special appendage, which is kidney-shaped and attached below the first fork. Blume says there are 2 such appendages; that the barren fronds are roundish, entire below, lobed above: fertile fronds 3–5 ft. long, many times forked, pale green. Java.—The fertile fronds of *P. biforme* are said to grow 15 ft. long sometimes. The picture in Gn. 4, p. 295, labeled *P. biforme* seems to be distinct and anomalous, though somewhat like *P. grande*.

3. **gránde,** J. Smith. Fig. 1848. This may be readily distinguished from *P. alcicorne* by its barren fronds, which are also stag-like, while those of *P. alcicorne* are not. Barren fronds stalkless; segments blunt, spongy, pale green, tomentose: fertile fronds in pairs, 3–6 ft. long: sori not at the base of every ultimate fork but against the upper edge of the disk, with an infertile fork projecting beyond on either side. North Australia. G.C. 1872:1137; III. 8:97 (good, repeated in III. 10:698 and 28:433). Gng. 5:169 (same as A.F. 6:701). F. 1850:47 (same as F.S. 6, p. 156). Not G.M. 40:135, which is *P. Æthiopicum*. Mn. 1, p. 77 (erroneously as *P. alcicorne*).

4. **Wállichii,** Hook. As in *P. grande*, the sori are borne not at the base of the ultimate forks, but on a disk which is not squared off at its upper surface but rounded and projecting into the angle between the forks. Sori roundish. Malay Peninsula. G.C. III. 28:435. Hook. Fil. Exot., plate 97.

5. **Willinckii,** Moore. Distinguished from *P. grande* by the sori, which nearly fill the last forks but do not approach the base of the sinus. The fronds are thinly furnished with minute stellate hairs, at length glabrous and pale green. Moore says: "fertile fronds in 3's, elongate, pendent, with scarcely any disk, bipartite for about two-thirds of their length, one of the margins of each primary branch entire, the other bearing numerous lobes in about three series on a dichotomous plan." Strong features of this plant are the length, narrowness and acuteness of the forks, and also the narrowness of the "disk" or unbranched portion just below the primary forks. Java. G.C. II. 3:303 (repeated in III. 10:701 and 28:431. A.G. 15:111. Gn. 10, p. 383 (repeated in Gn. 30, p. 300).

6. **Æthiòpicum,** Hook. (*P. Stemmària*, Beauv.). Barren fronds rounded; fertile fronds 2–3 ft. long, clustered, pendent, twice dichotomous (not twice trichotomous, as some writers say): sorus a V-shaped patch surrounding the sinus. Guinea, Angola. Hooker's Garden Ferns, plate 9. A.G. 15:111. G.M. 40:135 (erroneously as *P. grande*).—The fronds are said to be covered below with a thin cottony down.

7. **Hillii,** Moore (*P. alcicórne*, var. *Hillii*). Barren fronds like *P. alcicorne*, but the fertile fronds are erect, the unbranched portion longer, the forks more numerous and compact, the segments shorter and more acute. Fronds clustered thinly, covered when mature with white stellate hairs: sori in oval or roundish masses, not at the base of the sinus but near the base of each of the last segments. The upper third of the fertile frond is "15–18 in. across, 3-parted, the central segment with 1 or 2 side lobes near the apex, the 2 lateral segments broader and twice or thrice forked into 5–10 ultimate lobes." *T. Moore*. Queensland. G.C. II. 10:51, 428, 429. J.H. III. 32:497.

8. **alcicórne,** Desv. Barren fronds rounded, convex, wavy margined; fertile fronds clustered, attaining 2–3 ft., 2–3 times dichotomous, the unforked portion erect, the segments pendent, rather narrow and sharply cut, under surface covered with thin cottony down: sori in irregular masses filling the last forks and a space across their bases, shown in B.R. 3:262, 263 (as *Acrostichum alcicorne*). Temperate Australia. A.G. 14:153;

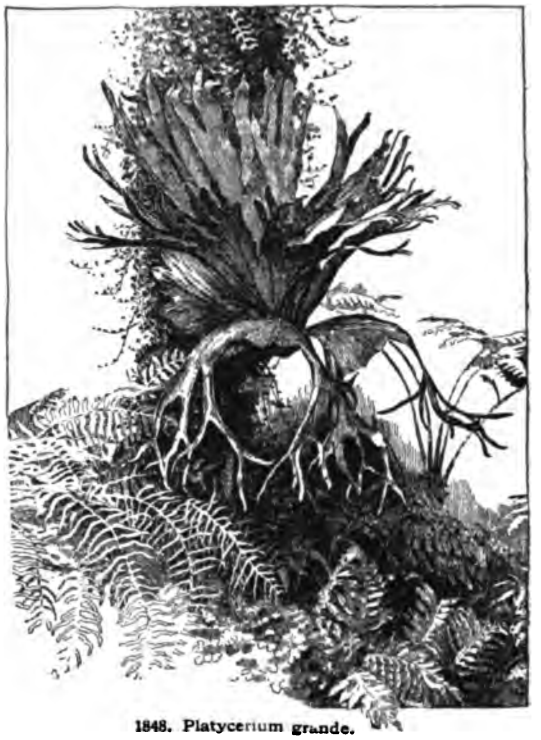
15:111. Gn. 51, p. 259. G.C. III. 10:697. Not Mn. 1, p. 77, which is really *P. grande*.

Var. **màjus**, Moore, is stronger-growing, more upright, and with thick, leathery, dark green fronds. According to F. L. Atkins, the fertile fronds are more broadly cut than the type and seldom forked more than once. Polynesia. Veitch's Catalogue 1873, p. 13.
W. M.

No private conservatory should make any pretensions to rank in the first class that does not take pride in at least one well-grown specimen of Platycerium. The Stag-horn Ferns are amongst the most beautiful and distinct of ferns—perhaps the most striking of all—because of their noble, antlered appearance and their epiphytal habit. They have two kinds of fronds, barren and fertile, the former being rounded disks which clasp the tree trunk, while the fertile fronds generally hang down and look like antlers. Occasionally the barren fronds are more or less antlered, as in *P. grande*, but never give so perfect a suggestion as do the fertile fronds. The species are all tropical, except *P. alcicorne*, which is therefore the easiest to grow and the commonest in cultivation. This species can endure a night temperature of 50° F. or even less. The glory of the genus, however, is *P. grande* (Fig. 1848). The barren fronds are exceptionally large, rounded and wavy margined at the base, deeply cut above, forming an erect or arching background to the pendent fertile fronds, which fork more times and have much narrower segments than the barren fronds. Unfortunately this is the only species that does not produce suckers at the roots, by which all the others are easily propagated. It alone must be raised from spores, a long and anxious process. The only kind that has an erect and rigid habit is *P. Hillii*, which therefore is grown in pots, while all the others may be grown on a block of wood, and some in baskets. *P. biforme* differs from all others in having a separate and specialized structure on which the sori are borne, the other kinds bearing their spore-masses on the under surface of the fertile fronds at or near the last forks. *P. biforme*, though advertised in America, is probably nowhere in cultivation in the world. There is an improved form of the common type known as *P. alcicorne*, var. *majus*, which is stronger-growing and has thicker fronds, enabling it to endure a drier atmosphere. It is therefore one of the best, if not the best, for exhibition purposes. At the other extreme from the slender grace of *P. alcicorne* and the rest is the bold and broad style of *P. Æthiopicum*. *P. Angolense* is the only one which bears no resemblance to antlers.

All the species require a moist atmosphere, though the humidity should be reduced during the winter. With the exception of *P. alcicorne* they all require a high temperature. All need perfect drainage, and in winter they should not have too much direct syringing, for they need a slight rest and are likely to spot or damp-off if water remains on the foliage too long. *P. Æthiopicum* is said to be particularly sensitive. Stag-horn Ferns are often grown on pieces of tree-fern stem. They are fastened to such support or to a board by means of wire, having first furnished the roots with a slit piece of peat for root-hold and some sphagnum moss, to which may be added a little bonemeal for food and some charcoal for drainage. A little moss may be added every year or two. Eventually the barren fronds will entirely cover this material and the plants should then be left undisturbed for years. A Stag-horn Fern, with antlers spreading 6 or 8 feet, is a sight never to be forgotten.
W. H. Taplin and F. L. Atkins.

PLATYCLÌNIS (Greek, *broad bed;* in allusion to the clinandrium). *Orchidàceæ*. Plants with small, closely crowded pseudobulbs, each with a single, narrow, evergreen leaf. The flowers are borne in graceful, drooping racemes 6–10 in. long. They are small and not showy, but the thread-like racemes arching from among the densely tufted green foliage give the plants a pleasing appearance. Sepals and petals spreading; labellum 3-lobed; column short, with an erect-toothed clinandrium and a large, narrow, erect wing on each side of the clinandrium. About 20 species in India, China and the Malay Islands.
Heinrich Hasselbring.



1848. Platycerium grande.

The several species of Platyclinis are all small, compact-growing plants, requiring but little root-space. They are of easy culture and readily adapt themselves to either pot or basket culture, the latter being preferable for those with pendulous flower-scapes. The roots do not like being disturbed, but when repotting is necessary it is best to do it just after the flowering period. The compost should consist of equal parts chopped live sphagnum moss and clean peat fiber. The roots should be carefully distributed and the compost pressed gently but firmly in around them, leaving the surface slightly convex when finished. At least two-thirds of the space should be devoted to free drainage with potsherds or bits of charcoal.

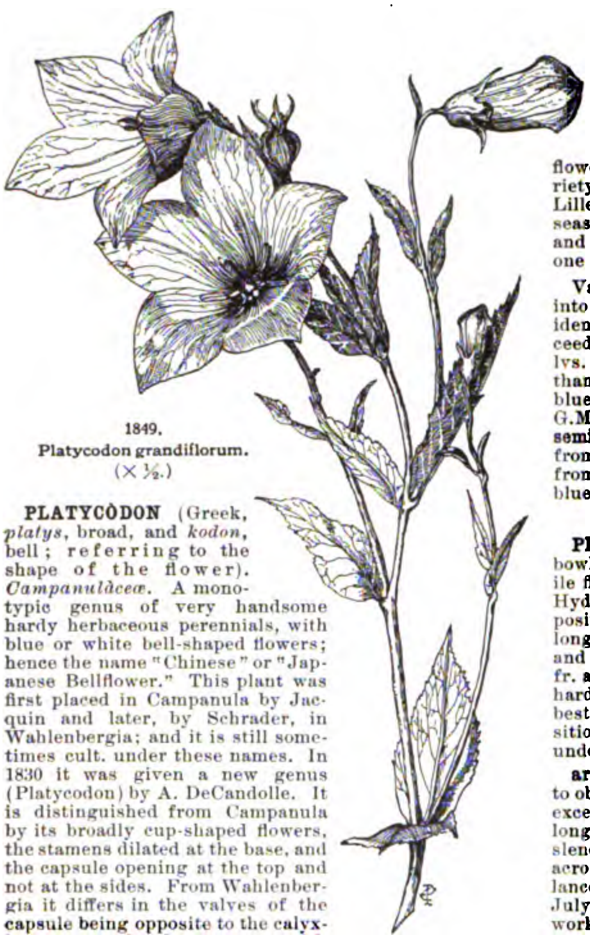
A shaded location and moist atmosphere, with a temperature of 60–65° F. by night and 70–75° by day, will afford them satisfactory growing conditions. They require a liberal supply of water at the roots, with occasional syringing overhead in bright weather when growing, and should never be allowed to remain long dry even when at rest. The plants frequently produce side growths from the old pseudobulbs, which may be removed after the growths are matured, leaving three or more of the old pseudobulbs attached to each piece, thus increasing the stock. When no natural break occurs, however, the plants may often be induced to break by slightly twisting, or notching the rhizome with a sharp knife, thereby retarding the flow of sap at that point.
Robert M. Grey.

glumàcea, Benth. (*Dendrochìlum glumàceum*, Lindl.). Pseudobulbs crowded, forming dense spreading masses, the young ones clothed with red scales: lvs. solitary, broadly lanceolate, tapering to a petiole which is enclosed by the sheath: peduncle from the top of the pseudobulb, slender, bearing a long, drooping spike of small white fls.: sepals and petals spreading, oblong, acuminate; middle lobe of the labellum rotund, curved, base with 2 fleshy ridges. Spring. Philippines. B.M. 4853. G.C. III. 18:552.

filifórmis, Benth. (*Dendrochìlum filifórme*, Lindl.). Pseudobulbs crowded: lvs. linear-lanceolate: flower-stem thread-like, bearing a long, pendulous raceme of small, pale yellow fls.: sepals and petals obovate; labellum cuneate-rotund, auriculate at the base. Summer. Philippines. I.H. 25:323 (as *Dendrochilum glumaceum*). G.F. 2:485.

Cobbiàna, Hemsl. (*Dendrochìlum Cobbiànum*, Reichb. f.). Lvs. oblong-lanceolate: fls. in a zigzag raceme, pale yellow, with an orange lip; sepals and petals triangular-oblong; labellum cuneate-fan-shaped, retuse. Nov., Dec. Philippines.

HEINRICH HASSELBRING.



1849.
Platycodon grandiflorum.
(× ½.)

PLATYCÒDON (Greek, *platys*, broad, and *kodon*, bell; referring to the shape of the flower). *Campanulàceæ.* A monotypic genus of very handsome hardy herbaceous perennials, with blue or white bell-shaped flowers; hence the name "Chinese" or "Japanese Bellflower." This plant was first placed in Campanula by Jacquin and later, by Schrader, in Wahlenbergia; and it is still sometimes cult. under these names. In 1830 it was given a new genus (Platycodon) by A. DeCandolle. It is distinguished from Campanula by its broadly cup-shaped flowers, the stamens dilated at the base, and the capsule opening at the top and not at the sides. From Wahlenbergia it differs in the valves of the capsule being opposite to the calyx-lobes instead of alternate with them Several supposed species have been described at different times, but there seems to be no doubt that the genus is distinctly monotypic and that all forms can be referred as forms of the type *P. grandiflorum*, which has been widely distributed and thereby greatly modified. It has been found in a wild state from Dahuria to Manchuria, in China, in Siberia, Corea and Japan.

Platycodon requires a medium sandy loam, and does not succeed in either extremely stiff or sandy soils. It is particularly sensitive to ill-drained soils. Under suitable soil conditions it is perfectly hardy and will even stand considerable neglect. It is desirable to keep the stems tied during the season, for if once allowed to fall they can never be raised without breaking. In autumn the old stems should not be cut away, but the plant allowed to die off naturally; otherwise the crown may be injured. It can be propagated either by division or by seeding, the latter being more surely successful and therefore preferable; besides, a greater variety of flowers is obtained in this way. More care and skill are necessary in propagation by division, because of the fleshy rootstock. It is best accomplished in spring, when the plant is breaking into new growth.

grandiflòrum, DC. (*Campánula grandiflòra*, Jacq. *Wahlenbérgia grandiflòra*, Schrad.). CHINESE OR JAPANESE BELL-FLOWER. BALLOON FLOWER. Fig. 1849. Plant 1–2 ft. high, forming a dense, branching bush of upright habit: lvs. lanceolate or ovate-lanceolate, glabrous, unequally toothed: fls. large and open, attaining 3 in. in diam., produced from tips of branches, inflated in the bud, hence sometimes called "balloon flower"; corolla 5-lobed, blue, pale blue-white, or variegated. June, July. G.C. III. 28:223. J.H. III. 30:123. F.S. 22: 2332. B.M. 252.—Var. **álbum.** A white-flowering form. Var. **autumnàle.** Later-flowering form from Manchuria. Gn. 45, p. 462. R.H. 1848:361; 1853: 547.

Var. **Japónicum** (*P. Japónicum*, Hort.) is of stronger and bushier growth and freer-flowering. The flowers average 2½ in. across; the inner and outer lobes alternate with one another, giving the flower the appearance of a 10-pointed star.—This variety was first procured by Dreer in 1895 from Leonard Lille, Lyons, France, who offered it as a novelty that season. It proved to be a first-class and desirable sort and has been tested by Dreer since, who considers it one of the good hardy perennials.

Var. **Marièsi** (*P. Màriesi*, Hort.). Recently introduced into England from Japan by Maries, and supposed to be identical with var. *glaucum* of Siebold. It does not exceed 1 ft in height: growth stouter and more compact: lvs. thicker than in the type: fls. are as large or larger than the type and varying in color from deep purplish blue to pale blue or lavender and white. G.C. III. 14:163. G.M. 37:35. J.H. III. 35:29. Gn. 27:483; 45:964.—Var. **semi-plenum.** Fls. semi-double, and varying in color from purple to white; said to have been developed from var. *album.* Var. **striàtum.** A garden form with blue or white fls., striped with white or blue.

ARNOLD V. STUBENRAUCH.

PLATYCRÀTER (Greek, *platys*, broad, and *crater*, bowl; alluding to the broad, enlarged calyx of the sterile fls.). *Saxifragàceæ.* A monotypic genus allied to Hydrangea. The species is a prostrate shrub, with opposite serrate lvs. and white, comparatively large fls. in long-peduncled, loose cymes, the marginal ones sterile and with enlarged calyx; petals 4; stamens numerous: fr. a 2-celled many-seeded dehiscent capsule. It is not hardy north, and of little decorative value. It thrives best in rather moist, porous soil and partly shaded position and is easily prop. by seeds, greenwood cuttings under glass, or layers.

argùta, Sieb. & Zucc. Prostrate shrub: lvs. oblong to oblanceolate, cuneate at the base, acuminate, glabrous except on the veins beneath, thin, light green, 3–6 in. long: cymes 3–10-fld., on a 1–2-in. long peduncle: fls. slender-pedicelled, the sterile ones apetalous, 1 in. across, with broad, obtuse sepals; fertile smaller, with lanceolate sepals half as long as the oblong-ovate petals. July. Japan. S.Z. 1:27. Gt. 15:516.—Useful for rock-work in greenhouses.

ALFRED REHDER.

PLATYLÒMA is a name for ferns of the genus *Pellæa* which have a narrow indusium and a broad sorus. For *Platyloma Bridgesii* and *P. falcata*, see *Pellæa.*

PLATYSTÈMON (Greek words referring to the dilated filaments). *Papaveràceæ.* CREAM CUPS. A half-hardy annual growing about a foot high and bearing 6-petaled pale yellow fls. 1–1½ in. across. This plant is improperly called California Poppy in some catalogues. It is inferior to the common and California poppies in hardiness, in strength and variety of color, and in size of fls., but it is interesting botanically in four respects: (1) It is unique in the poppy family in its fruit, which is not a capsule but is composed of numerous carpels that separate at maturity into linear parts, which are moniliform (i.e., compressed at intervals like the links of a necklace), each joint containing a single seed. (2) It is remarkable for the dilation of the filaments of the anthers, which are numerous and separate. (3) It is one of the few abnormal members of the poppy family with entire lvs. (4) The petals are not shed quickly, as in the common poppies, but they wither and remain closed over the forming fruit. Platystemon grows wild throughout California, except in the mountains, and is said to prefer a loose soil. See *Annuals.*

Califórnicus, Benth. CREAM CUPS. Lvs. mainly opposite, sessile, ligulate, hispid: fls. light yellow to cream color or white, rarely roseate; sepals 3. B.M. 3579. B.R. 20:1679. B. 2:65. Gn. 30, p. 313.—The smooth-fruited form figured as *P. leiocarpum* in F.C. 2:76 and B.M. 3750 is said by the Synoptical Flora to be "a mere state."

W. M.

PLATYSTÍGMA (Greek, *broad stigma*). *Papaveràceæ.* Low, slender California annuals with pale yellow fls. less than 1 in. across. They are among the few plants of the poppy family with entire lvs. They are closely allied to Platystemon, but differ in having the filaments scarcely dilated, 3 stigmas instead of many, and the fr. a capsule which is 3-valved at the apex. Other generic characters: fls. commonly trimerous; stamens numerous, free; stigmas not confluent. Four species from Calif. and Oregon. *P. lineare* is the only one with thick stigmas and also differs in its tufted habit, the others having leafy and branching stems. It is figured in B.M. 3575 with pale yellow fls.; in B.R. 23:1954 it is shown with 3 white petals alternating with yellow ones. Platystigmas seem never to have been offered for sale in America.

PLATYTHÈCA (Greek, *broad anther cells*). *Tremandràceæ.* A heath-like Australian shrub, with foliage like a bed-straw (or Galium) and many 5-pointed starry blossoms of light purple borne toward the end of the branches. Each flower is about 1 inch across, and its center is marked with a star of red. Platytheca belongs to a small, beautiful and distinct family of Australian shrubs, composed of 3 genera, of which Tetratheca is the dominant type. The Tremandra family resembles the Polygala family in the structure of the capsule, but differs in the regularity and estivation of the flower; it resembles the Pittosporaceæ in having a very small embryo immersed in copious albumen, and particularly the genus Cheiranthera in having anthers which open by a pore at the top. The three genera of Tremandraceæ are distinguished from one another by the anthers; Tremandra differs from the other two in having the anthers jointed with the filaments; in Platytheca the anthers have 4 cells all in the same plane; in Tetratheca the anthers are 2-celled or 4-celled, with 2 cells in front of the 2 others.

Other generic characters of Platytheca: floral parts in 5's; stamens in 2 distinct series, with 4 parallel cells in a single plane contracted into a tube at the top: capsule opening loculicidally at the edge, with the 4 valves splitting septicidally: seeds glabrous, without appendage. Only one species.

galioides, Steetz. (*P. verticillàta,* Baill.). Lvs. linear, ¾ in. long, about 10 in a whorl, hairy. Said to bloom in June. P.M. 13:171 (as *Tetratheca verticillata*).—This plant deserves to be better known. Cuttings of half-ripened wood root freely under a bell-glass in a shaded house at 60°. Cuttings rooted in February or March will make good plants in 5-inch pots in one year. In summer keep them plunged outside, but covered with shaded sash. By trimming frequently they will make well-shaped plants, needing no supports. Kept in a coolhouse (45°) during winter, they will be covered with bloom in March and April. The flowers last but a short time, but the plant is so free that it is always covered with bloom.

H. D. DARLINGTON and W. M.

PLECTOCÒMIA (Greek, *plaited hair;* application obscure). *Palmàceæ.* Six species of East-Indian climbing palms which fruit once for all and then die. One of the most interesting species is *P. Khasyana,* which is figured in B.M. 5105 under the erroneous title of *P. Assamica.* This species has a slender stem 60–80 ft. long, and about as thick as a man's arm, being slightly thicker above than at the base. The lvs. attain 30 ft. and are pinnate only in the lower half, the rest of the leaf being a long, whip-like extension of the rachis of the leaf. A singular feature of this palm is the device by which it climbs. This consists of a series of compound spines shaped like a downward-pointing human hand, the back of the hand being yellow and the 5 or 6 fingers composed of brown spines. These organs are scattered all along the lower side of the flattened rachis. They hook on the branches of trees and thus enable the palm to climb for light.

"A yet more wonderful provision of nature," says Hooker, "is observed in the young and yet unfolded leaves of these plants during the period when they insert themselves upwards among the branches of the forests, for then these spines are upright and lie flat against the stalk of the leaf, not becoming reflexed till they are needed as a means of support." Probably all the species possess these flagelliform leaves and remarkable spines. The whip-like leaf-tips may act as tendrils. The genus is little known to cultivators, and only one species is offered in the U. S. The genus is allied to the rattans (Calamus), which also are climbers. William Watson writes that the fruit of a Plectocomia is a shell composed of many small, tightly overlapping scales, inclosing a round seed which has a solid whitish albumen almost as hard as ivory. Watson adds that young plants are ornamental, but their spiny lvs. are a drawback, and the lvs. are much more easily broken than those of most palms.

elongàta, Mart. Lvs. very large; lfts. 1–1½ ft. x 2 in., sparsely white powdery beneath, with 3 very slender parallel nerves or costæ. Penang, Sumatra, Java.—Offered in 1890 by Reasoner Bros.

PLECTOPÒMA. A few species, now apparently much hybridized, all referred to *Gloxinia.*

PLECTRÁNTHUS (Greek, *spurred flower*). *Labiàtæ.* A large and uninteresting genus of herbs and subshrubs, widely scattered, bearing rather small or smallish fls., ranging from blue and purple to lilac. There are said to be some species with fls. nearly an inch long. The genus is closely allied to Coleus, being distinguished by having the stamens free instead of united at the base into a tube, which is distinct from the corolla. In other respects the genus has wide limits of variation. Sixty-six species are described in DC. Prod. 12:55 (1848). Sometimes called Cockspur-flower.

fruticòsus, L'Hérit. South African shrub, 3–4 ft. high: lvs. 4 in. or more long, petiolate, broadly ovate, doubly dentate: racemes laxly panicled: whorls about 3–6-fld.: fls. blue; pedicles 1½ in. long; corolla-tube spurred above the base: fruiting calyx declinate.—Said to be an elegant shrub. Ernest Braunton has a specimen at Los Angeles, which is 4 ft. high and 6 ft. through.

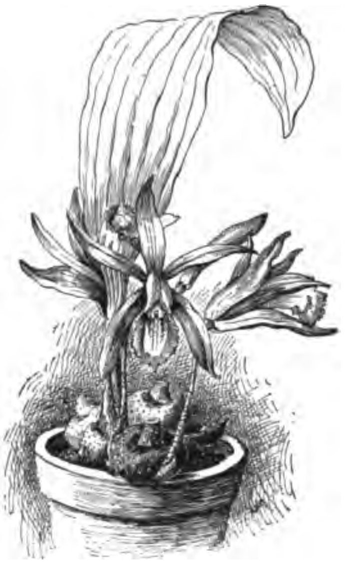
PLECTRÒNIA (Greek, *cockspur;* referring to the spines). *Rubiàceæ.* About 70 species of shrubs or small trees, found in the Old World, mostly in the tropics. They are more or less spiny and have somewhat funnel-shaped, 5-parted fls., with reflexed segments valvate in the bud, and a hairy or naked throat. Calyx obovate or oblong; stamens 5, in the throat; style short; stigma subcapitate, of 2 approximate lamellæ: berry obovate-oblong, compressed, didymous, 2-stoned: stones indehiscent, 1-seeded.

spinòsa, Klotzsch. Very spiny South African shrub, 5–8 ft. high: lvs. fasciculate, oval or obovate, obtuse, entire, 1–1½ in. long: racemes or panicles shorter than the lvs.: peduncles axillary, 5–12-fld.: corolla-tube shorter than the limb; throat naked. Int. by Franceschi, Santa Barbara.

PLEIÒNE (from Greek mythology; *Pleione,* mother of the Pleiads). *Orchidàceæ.* A small genus closely related to Cœlogyne, but having annual deciduous lvs. and pseudobulbs. Natives of the mountains of India, extending to elevations where snow and frost are not uncommon. Few species are cultivated in America. See *Orchid.*

maculàta, Lindl. Pseudobulbs round, flattened, depressed at the top, forming a fleshy ridge around the summit: lvs. lanceolate, from inflated sheaths: fls. preceding the lvs., on short peduncles; sepals and petals lanceolate, spreading, white; labellum funnel-shaped, with 5–7 fringed lamellæ extending the entire length of the labellums, side lobes streaked with purple, middle lobe ovate, wavy, white, spotted with purple and yellow. The lvs. fall in Sept.; fls. in Nov. B.M. 4691. F.S. 14:1470. F. 1851:97 (all as *Cœlogyne maculata*).—Var. **Bermánica** was once offered by Wm. Mathews.

prǽcox, D. Don (*P. Wallichiàna*, Lindl. & Paxt.). Fig. 1850. Pseudobulbs flask-shaped, depressed, dull green, warted and covered with a network of the old split sheaths: lvs. broadly lanceolate, plicate: fls. large, on short peduncles; sepals long lanceolate, spreading, pink; petals similar but narrower; labellum trumpet-shaped, indistinctly lobed, pink, white and yellow in the throat; disk with longitudinal fringed lamellæ, margin dentate-fimbriate. Oct., Nov. B.M. 4496. B.R. 26·24. P.M. 6:25 (all as *Cœlogyne Wallichiana*).


1850. Pleione præcox (× ⅛).

Lagenària, Lindl. & Paxt. Pseudobulbs clustered and depressed, as in the other species, dull green, mottled with brown: fls. about 4 in. across, rose-lilac; sepals and petals narrowly lanceolate; labellum convolute, crisp on the margin, pale lilac, blotched with yellow and deep crimson in the throat and having several yellow crests. Aug.–Nov. Himalaya Mts. B.M. 5370. F.S. 23:2386. I.H. 14:510 (all as *Cœlogyne Lagenaria*). Gn. 51, p. 64.

Reichenbachiàna, T. Moore. Pseudobulbs 5–8-grooved, flask-shaped but suddenly contracted at the top: scape 1–2 in. long, closely sheathed: sepals and petals linear-oblong, pale purple to white; labellum nearly white, middle lobe white with few pale purple spots, with 3 crests; margin ciliate-toothed. Autumn. Rangoon. B.M. 5753.

Heinrich Hasselbring.

PLERÒMA. See *Tibouchina*.

PLEURISY ROOT is *Asclepias tuberosa*.

PLEUROTHÁLLIS (Greek, *lateral branch;* referring to the inflorescence, which arises from the axil of the leaf). *Orchidàceæ*. One of the largest of the genera of orchids containing about 400 species, dispersed in the region extending from Brazil and Bolivia to Mexico and the West Indies. On account of their small, inconspicuous flowers these plants are of no horticultural value, and not generally cultivated. Stems clustered on the rhizome, sheathed with scales below and bearing a single leaf at the summit: fls. in a nodding raceme from the axil of the leaf; sepals free or the lateral ones united at the base; petals smaller; labellum free, similar to the petals or 3-lobed; column short, without lateral branches.

Rœ́zlii, Reichb. f. Lvs. oblong-lanceolate, 4–10 in. long: flower-stem often a little longer than the lvs.: fls. purple-brown, in a one-sided raceme. Colombia.

ornàta, Reichb. f. A very small cespitose plant with lvs. scarcely 1 in. long: fls. opening successively on erect, zigzag racemes a few inches long, inconspicuous, yellow with brown spots. B.M. 7094.—The plant is easily distinguished by the sepals, which are fringed with silvery pendulous hairs.

Heinrich Hasselbring.

PLUM. Plate XXX. It is probably more difficult to give specific practical advice for the management of the Plum than for any other common fruit. This is because the cultivated Plums represent several distinct species which are not equally adapted to all parts of the country, and the same remarks will not apply to them all. There is no country in which the domesticated Plum flora is so complex as in North America, for we not only grow the specific types of Europe and of Japan, but also species that are peculiar to our own country. In the northeastern states and on the Pacific slope the European or Domestica types are the leading Plums. In these same areas and also in the South and in parts of the mid-continental region, the Japanese Plums are now popular and are gaining in favor. In the cold North, in the great interior basin, and also in most parts of the South, various native types now constitute the leading cultivated Plums. These native Plums are developed from wild species of the country, and they are unknown in cultivation (except in botanical or amateur collections) in any other part of the world. These have been developed chiefly within a half century, although a few varieties are older than this. For a history of this evolution, see "Sketch of the Evolution of our Native Fruits."

The Plums cultivated in North America belong to the following groups (see *Prunus*):

1. Domestica or European types, *Prunus domestica*. Native to western Asia. Comprises the common or old-time Plums, such as Green Gage, Lombard, Bradshaw, Yellow Egg, Damsons, and the like. The leading Plums from Lake Michigan eastward and north of the Ohio, and on the Pacific slope. Figs. 1851 to 1856 are of this species. Of late years, hardy races of *Prunus domestica* have been introduced from Russia. These have value for the colder parts of the plum-growing regions. Figs. 1853–5 show representative forms of the Russian type.

2. The Myrobalan or cherry-Plum type, *Prunus cerasifera*. Native to southeastern Europe or southwestern Asia. Much used for stocks upon which to bud Plums, and also the parent of a few named varieties, as Golden Cherry; and DeCaradeuc and Marianna are either offshoots of it or hybrids between it and one of the native Plums.

3. Japanese types, *Prunus triflora*. Probably native to China. The type seems to be generally adapted to the United States, and will certainly be of great value to both the South and North. This species first appeared in this country in 1870, having been introduced into California from Japan. For historical sketch, see Bull. 62, Cornell Exp. Sta. (1894); also Bull. 106 (1896).

4. The Apricot or Simon Plum, *Prunus Simonii*. Native to China. Widely disseminated in this country, but little grown except in parts of California. Introduced about 1881.

5. The Americana types, *Prunus Americana*. The common wild Plum of the North, and extending westward to the Rocky mountains and southward to the Gulf and Texas. Admirably adapted to climates too severe for the Domestica Plums, as the Plains and the upper Mississippi valley. See Cornell Bulletin 38 for an early account of the native Plums. Fig. 1857.

6. The Wild Goose or Hortulana types, *Prunus hortulana*. A mongrel type of Plums, comprising such kinds as Wild Goose, Wayland, Moreman, Miner and Golden Beauty. These are no doubt hybrids of the last and the next.

7. The Chickasaw types, *Prunus angustifolia* (or *P. Chicasa*). Native to the southern states, and there cultivated (from southern Pennsylvania southwards) in such varieties as Newman, Caddo Chief and Lone Star.

8. The Sand Plum, *Prunus angustifolia*, var. *Watsoni*. Native to Kansas and Nebraska. A bush-like species, little known in cultivation. A hybrid of this and the Western Sand Cherry is the Utah Hybrid Cherry.

9. The Beach Plum, *Prunus maritima*. Native to the coast from New Brunswick to Virginia. In cultivation represented by the unimportant Bassett's American; also as an ornamental plant.

10. The Pacific coast Plum, *Prunus subcordata*. Native to Oregon and California. Sparingly known in cultivation, chiefly in the form known as the Sisson Plum (var. *Kelloggii*.)

The Plum of history is *Prunus domestica*. It is to this species that general pomological literature applies. It gives us the prunes (which see). Perhaps it would be serviceable to classify the Domestica Plums into five general groups, although any classification is arbitrary at certain points:

(*a*) Prunes, characterized by sweet firm flesh, and capable of making a commercial dried product. They may be of any color, although blue-purple prunes are best known. Some of the prunes are grown in the East as ordinary market Plums, being sold in the fresh state. Almost any Plum can be made into dried prunes, but the varieties used commercially for this purpose constitute a more or less distinct class of firm and thick-fleshed kinds. In the East, prune is nothing more than a varietal name. See *Prune*.

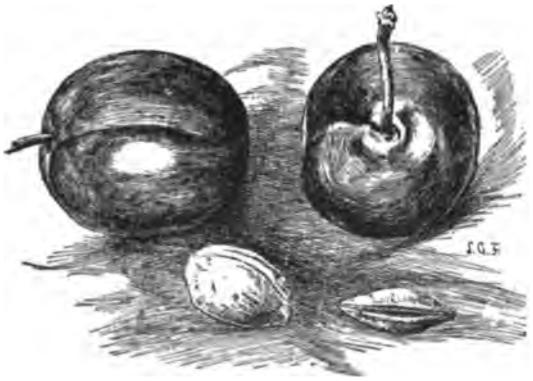
(*b*) Damsons, comprising very small, firm Plums of various colors, generally borne in clusters, the leaves mostly small. The run-wild Plums of old roadsides and farmyards are mostly of the Damson type. Fig. 1856.

(*c*) The green gages, comprising various small, green or yellow-green Plums, of spherical form and mostly of high quality. Reine Claude is the commonest representative of this group in the East. The name Green Gage often stands for a group rather than for a variety.

(*d*) Large yellow Plums, such as Coe Golden Drop, Washington, and the like.

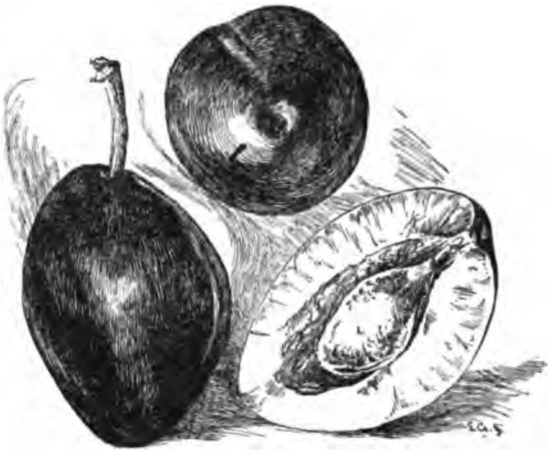
(*e*) Large colored Plums, including the various red, blue, and purple varieties, like the blue prunes, Lombard, Bradshaw, Quackenboss, etc.

The Japanese Plums (*Prunus triflora*) differ from the Domesticas in having longer, thinner, smooth and mostly shining leaves, smooth twigs, a greater tendency to the production of lateral fruit-buds on the annual growth, and mostly rounder or shorter fruits with colors running more to cherry-reds and light yellows. Most of the varieties are as hardy as the Domestica series. The Japanese varieties are important because they add variety to the list, and especially because they are rich in very early kinds, and the fruit is so firm that it carries well; aside from this, the trees are vigorous and very productive, and they are less liable to injuries from black-knot and curculio than the Domesticas are.



1851. Plum—Peter Yellow Gage (× ½).

The native Plums, chiefly offspring of *Prunus Americana*, *P. angustifolia* and *P. hortulana* (the last name now believed to represent a hybrid class), represent a wide range of varieties. Those from *Prunus Americana* parentage are very hardy and are adapted to regions in which the Domestica and Japanese types are tender, as in northern New England, parts of Canada, and the northern Plains states. Those partaking strongly of *P. angustifolia* parentage, and the greater part of the Hortulanas, thrive well in the South, where the climate is too continuously hot for other Plums or where the fruit-rot fungus is too prevalent.



1852. Plum—Fellenberg or Italian Prune (× ½).

Plum-growing.—The Plum thrives on a variety of soils. The Domesticas generally do best when planted upon clay loam. They usually thrive best on lands which are suited to pears, or on the heavier lands to which apples are adapted. Yet there are many varieties which grow well on lands that are comparatively light or even almost sandy. The Americanas thrive best in a rather moist soil, and mulching is often very favorable to the size and quality of the fruit.

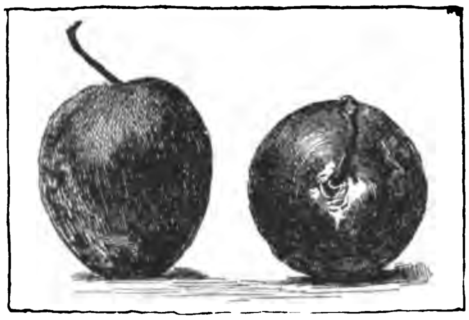
The stocks upon which Plums are grown are very various. By far the greater number of the trees in the North are now grown upon the Myrobalan stock, which is a species of rather slow-growing Plum, native to southeastern Europe and southwestern Asia. This is the stock that is sometimes recommended in the older fruit books for the making of dwarf trees; but unless the top is kept well headed in, the trees generally make normal growth upon it. Trees grown upon this root are usually larger and finer at one or two years of age than those grown upon other Plum stocks, and the probability is that they are nearly as useful from the grower's standpoint as any other. However, there are some varieties that overgrow the Myrobalan, and the stock is likely to sprout from the ground and thereby cause trouble. Probably the most ideal stock for Domesticas, from the standpoint of the grower, is the Domestica itself, but seeds of it are more difficult to secure, the stock is more variable and it is more likely to be injured in the nursery row by leaf fungi; therefore, as a matter of practice, the Myrobalan has very generally supplanted it. In the southern states the peach is largely used as a stock upon which to grow Plums, and it seems to be gaining favor in the North. It is undoubtedly a very excellent stock for sandy lands, and, in fact, is probably better for such lands than the Myrobalan itself. Some varieties—of which Lombard and French Damson are examples—do not take well on the peach. The Japanese Plums are commonly worked upon the peach. The Marianna stock, which is much recommended in the South, has not found favor in the North. Some varieties of Plums are such slow and crooked growers in the nurseries that it is advisable to top-graft or bud them on some strong and straight stock. The Lombard is no doubt the best stock for this purpose now grown by nurserymen. The old Union Purple is one of the best stocks, but it is not much grown at the present time. Reine Claude, German Prune, Copper, are probably best when top-worked on some strong stock. For many native varieties, seedlings of vigorous natives, as of Golden Beauty and Wayland, make excellent stocks. Americanas should be worked on their own seedlings, at least in the North. In the South they are often budded on Marianna.

Plum trees are usually planted when two years old from the bud, although some of the strong-growing kinds may be planted at a year old with the very best results. As a rule, Plum trees are planted about as far apart as peaches are, that is, from 15 to 20 feet apart each way. Many growers prefer to plant them closer one way than the other and eventually to stop cultivation in one direction. If this system is used, they may be placed 18 or 20 feet apart one way, and from 8 to 12 feet the other way. When planted, the trees are pruned in essentially the same way that apple trees are. It is generally advisable to start tops as low as possible and yet allow of the working of the curculio catcher below them. This means that the limbs should start from 3 to 4 feet above the ground. With the modern implements and methods of tillage, there is little inconvenience in working the land if tops are started as low as this. The subsequent pruning of the Plum tree has no special difficulties. About four or five main limbs are allowed to form the framework of the top, and in most varieties, especially those which are not very tall growers, the central trunk or leader may be allowed to remain. The fruit of the Domesticas is borne mostly on spurs, as shown in Fig. 1858. These spurs, therefore, should not be removed unless it is desired to thin the fruit. In the Americanas and the Japanese varieties, the fruit is borne both on spurs and on the annual axial growth.

Insects and Diseases.—The black-knot is one of the most serious Plum diseases. It is best kept in check by systematically cutting it out. The grower should go over his orchard for it in the summer time and again as soon as the leaves fall. If trees are thoroughly sprayed every year with Bordeaux mixture for the leaf-blight fungus, the black-knot will make comparatively little headway in the orchard.

The blight, which causes the leaves to fall in August or September, is one of the most serious diseases in the Plum orchard; but the disease can readily be kept in check by thorough spraying with Bordeaux mixture two or three times during the summer. The mixture for spraying Plums should be weaker than for apples, particularly for the Japanese varieties.

The fruit-rot is the work of a fungus. Many times the dead and dried fruit may be seen hanging on the tree all winter, as shown in Fig. 1859; and in such cases it is very likely that the fruit-spur may be killed, as the upper one in the picture has been. In handling this disease, the first consideration is the fact that some varieties are much more susceptible to it than others. The Lombard is one of the worst. Again, if the fruit grows in dense clusters, the disease is more likely to be severe. The thinning of the fruit, therefore, is one of the very best preventives of the spread of the disease, and at the same time, also, one of the most efficient means of increasing the size, quality and salableness of the product. Thorough spraying with Bordeaux mixture is a specific for the trouble.



1853. Early Red, one of the Russian Plums (× ⅔).

The curculio, which causes wormy fruit, can be held in check by the jarring process, as described under *Peach*.

For literature on Plums, see Waugh's "Plums and Plum Culture;" Bulletins by Waugh, Goff and Craig, chiefly on Native Plums. Bull. 131. Cornell Exp. Sta. (from which the above account is adapted); bulletins of Cornell Exp. Sta. on Japanese Plums, and also No. 38 on Native Plums.

L. H. B.

1854. Moldavka, a Russian Plum (× ⅗).

Cultivation of Native Plums.—Approximately 300 varieties of Plums, derived chiefly from 6 native types, are now propagated by American nurserymen and planted in American orchards. A large number of these varieties are comparatively worthless, and must presently be discarded. A creditable minority, however, has qualities of absolute and considerable merit, and may be looked on as permanent additions to our pomological wealth. The native varieties are now propagated and planted by thousands annually, both for home use and for market. For certain culinary purposes many of the natives are superior; and in many places, particularly in states of middle latitude, they are the most profitable market Plums grown.

The Americana Plums are especially qualified to withstand the severity of northern winters. They are superlatively hardy. They are practically the only Plums grown in the cold northwestern states (except the comparatively unimportant Nigras and the Miners) and their usefulness in northern New England and middle Canada is limited only by the extent to which they are known. Their cultivation has been developed to a special degree in Iowa, Wisconsin, Minnesota, and adjacent states. For this region they must be propagated always on Americana stock. This stock has other advantages besides its hardiness, and it is rapidly coming into extensive use for all sorts of Plums in the northwest. The sand cherry is sometimes used as a stock, but has not yet passed the experimental stage. It dwarfs Americana Plums worked on it. It is perfectly hardy.

The Americana Plums are wayward and awkward growers. With many varieties it is impossible to make a comely orchard tree. They do not appear to take very kindly to pruning; and the usual method has been to let them very much alone. Careful pruning during the first few years, directed with a view to forming an open top on comparatively few supporting main branches, will do something toward shaping the trees; but with our present knowledge, no extensive pruning can be recommended for mature trees. The method of heading-in, as often practiced with the Domestica Plums, is especially unadapted to the Americanas.

The Americana Plums are early and very prolific bearers. Overbearing is a habit and a serious fault with most varieties. Extensive thinning of the fruit is indispensable. The trees are sometimes severely attacked by shot-hole fungus, and thorough spraying with Bordeaux mixture is necessary. The fruit-rot (monilia) attacks all the native Plums more or less, and must be controlled by Bordeaux mixture. See *Spraying*.

The Nigra group has two or three important varieties of superior hardiness, as Cheney and Aitkin. In general they bloom earlier, and fruit less heavily than the Americanas. Their habits and culture are the same.

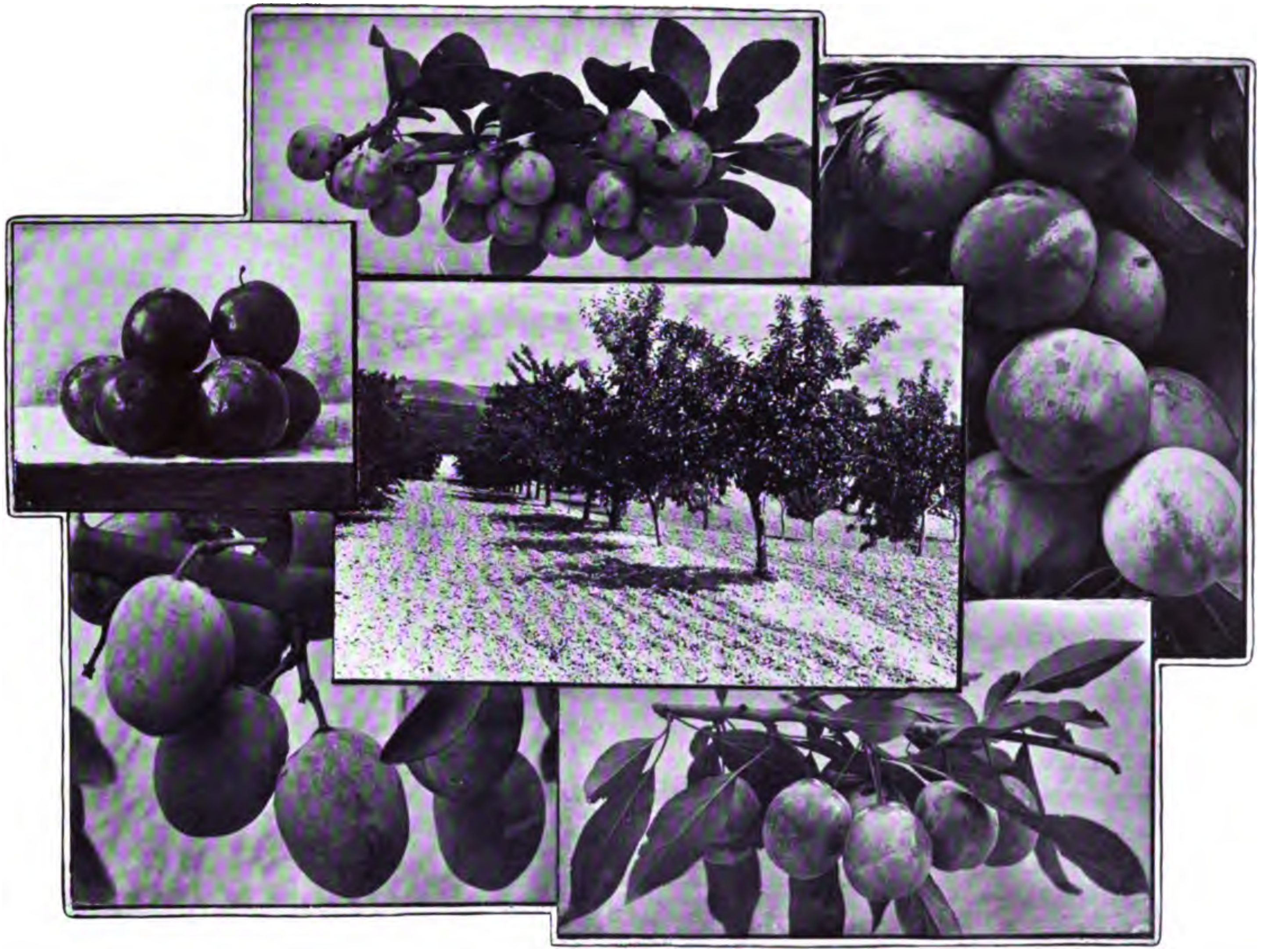


Plate XXX. Plums.

Center, a New York Plum orchard; top center, Damson Plum, *Prunus domestica*, var. *Damascena*; upper right-hand corner, Japanese Plum, *Prunus triflora*; lower right-hand, Chickasaw Plum, *Prunus angustifolia*; lower left-hand, common purple Plum (Middleburgh), *Prunus domestica*; left side, Forest Garden Plum, *Prunus Americana*.

The Miner-like varieties are hardly to be distinguished from the Americanas in any way. They have practically the same geographical range, and may be given the same treatment in the orchard.

The Wayland group includes several varieties of great value, especially for the South. Of these Wayland, Golden Beauty, Moreman, Benson, and Kanawha may be mentioned. They are not to be recommended generally for localities north of Massachusetts and Nebraska, their northern limit being determined less by their non-hardiness than by the very late ripening. This habit of late ripening, combined with very late blooming, makes them desirable for late marketing, particularly in southern markets. They are very prolific and constant bearers. The trees are free-growing, usually of rather spreading habit, and will bear heading-back better than the Americanas. The pruning knife, if used in season and with good judgment, will assist in making comparatively open-headed and amiable trees of these varieties.

The Wild Goose group includes varieties like Wild Goose, Milton, Wooton, and Whitaker, specially adapted to the latitude of Maryland, Kentucky and Kansas. The same varieties succeed only less well southward; but are not generally valuable to the north of this line. For the section named, the varieties of this class have unquestionably been the most profitable Plums grown up to the present time. They are propagated chiefly on peach, Marianna and Myrobalan. These stocks are all fairly satisfactory, though not equally good for all varieties; but when peach stocks are used the union should be made by whip-grafting on the peach root. Otherwise the peach stock comes above the ground and is a prey to the peach borer. The trees are mostly rapid, willowy, rather zigzag growers; and are amenable to the pruning knife in about the same degree as the Wayland-like varieties already mentioned. Whitaker makes an open-headed tree without much trouble. So does Sophie. Wild Goose is more inclined to be thick and thorny in the top, but may be thinned carefully to make an accessible head. Milton is much like Wild Goose. Wooton makes a fine vase-form top, which, with a little timely pruning, is almost ideal. Wilder, James Vick, and some others, are prone to make thick, bushy, thorny tops, and are hard to manage. These varieties are all considerably subject to shot-hole fungus, which often strips them of their foliage in midsummer. They are mostly thin-skinned and liable to crack at ripening time, especially if the weather is wet. They should be picked rather green for shipment, the point to be observed being that they have attained their full size, rather than that they are dead ripe.

The Chicasaw varieties are very effective pollinizers for all the Wild Goose and Japanese varieties blooming at the same time; but very few of them have sufficient value in themselves to make them profitable orchard trees. A few varieties, like Munson and McCartney, are still planted for their own fruit; but in general they have been displaced by other types of Plums. The trees are mostly bushy, thorny and thick-topped, sometimes so thick and thorny that the blackbirds can hardly get in to steal the fruit. It is difficult to prune them enough to make really satisfactory trees. The Chicasaw Plums are specially adapted to the southern states, though Pottawattamie, an exceptionally hardy variety, succeeds as far north as southern Iowa and central Vermont. They propagate readily on any kind of stocks.

Other types of native Plums, such as the Sand Plum, the Beach Plum, the Pacific Plum, etc., are not sufficiently numerous in cultivation for their treatment to have been determined.

Hybrid Plums of various strains are now beginning to come to the fore. Most of these hybrid varieties resemble rather strongly one or the other of their parent species; and the best that can be said regarding their culture at this early day is that they may be safely treated like the varieties which they most closely resemble. Wickson, President and perhaps Climax, with some others, resemble the Simon Plum, and ought to have much the same treatment, that is, practically the same treatment as the Japanese varieties. Gonzales, Excelsior, Golden and Juicy, on the other hand, resemble the Wild Goose type, and may have the same general treatment as Wild Goose.

All the native Plums, with very unimportant exceptions, require cross-pollination. For the most part, however, they are fully inter-fertile, so that a given variety will pollinate any other variety, providing the two bloom at the same time. Simultaneous blooming is of chief importance in adjusting varieties to one another for cross-pollination. To determine which varieties bloom together, careful observations should be made in the orchard and recorded, or recourse must be had to the published tables. Pollination is effected chiefly, if not exclusively, by the bees, so that their presence should be encouraged.

Most of the native Plums make comparatively small trees, so that they may be set somewhat close together in orchard-planting, say 12 to 20 feet apart, usually about 15 feet. Some varieties, particularly in the South, need 20–30 ft. space. Putting a Plum orchard down to grass is not admissible under any circumstances; but cultivation should cease with the first of July, or certainly by the middle of July; for the native Plums are especially liable to make too much late summer growth. High manuring of the soil is not usually necessary, or even desirable: yet something considerably short of starvation will be found the best treatment for native Plums.

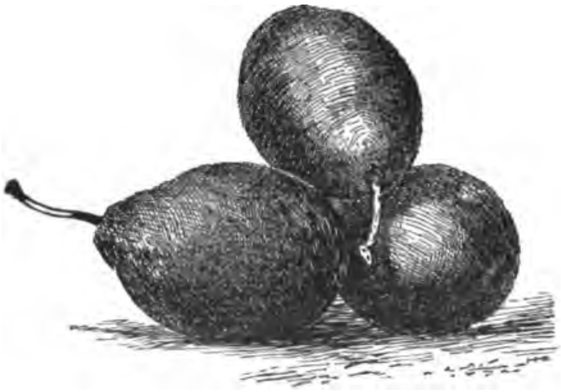
F. A. WAUGH.

THE PLUM IN CALIFORNIA. — The cultivation of the Plum in California differs widely from that in the other Plum-producing sections of the U. S. Here the dreaded curculio is unknown, and while the equally dangerous black-knot has been found infesting a native wild cherry (*P. demissa*) it has never been observed in cultivated orchards. The former has been kept out by rigid inspection and quarantine regulations, and the latter is undoubtedly held in check by the existing climatic conditions—excessive dryness being unfavorable to its development. Here, then, the most delicate varieties of the Old World find a very congenial home, and therefore, unlike the prevailing custom of much of the eastern Plum-growing, form the basis of practically all orchard planting. In early mining days the California native Plum (*Prunus subcordata*) was frequently cultivated, and before the introduction of European standard varieties attempts were made to improve the fruit by the usual methods of selection. Some very promising results were obtained; but since the demonstration of the great success of the more delicate and higher-flavored varieties, there has been little incentive to the use of the native species. There are two varieties, the type being a low shrub, rarely over 3 ft. high, branching from the ground; the fruit oblong, about ¾ in. long, "almost the shape and color of a Damson when ripe," but the pulp is described as "inferior." The other variety (*Kelloggii*) forms a larger shrub, from 10 to 15 ft. high, with larger fruit, round, yellowish in color and much more acceptable, both for eating and preserving. The two varieties are usually found associated, "growing in patches at the heads of ravines, on rocky hillsides and in open woods." The larger variety is not so widely distributed, and seems to have reached its highest state of perfection in the Sierras, where (in Sierra county) it is still preferred in the local markets, and where, it is said, the imported varieties "do not pay for the picking."

With the Plum fruits might also be mentioned the "oso berry," or so-called "California false Plum" (*Nuttallia cerasiformis*), a shrub sometimes 15 ft. high, and found "in moist places and the north sides of hills from San Luis Obispo northward." The bark is smooth, much resembling that of the Plum or cherry; the fruit is plum-like, pulpy, when ripe covered with a deep blue bloom, handsome in appearance, and has been used in the kitchen for making pies, preserves, and the like, though it is rather bitter to the taste. So far as known, no attempts have been made to improve it by cultivation.

It seems hardly fair to make a distinction between "Plums" and "prunes" in discussing this subject from the California standpoint. With the exception of the differences in the preparation for market, what may be said of the Plum applies as well to the prune; for a prune is simply a Plum which dries sweet without removing the pit. In most of the varieties of Plums there occurs a fermentation around the pit in the process of drying, which prevents their being successfully dried without its removal; these are known as "Plums." The prune varieties are, however, much sweeter and contain less acid; but the main distinction is in their adaptability of drying whole. As California has to find distant markets for most of her immense fruit crops, it follows, then, that by far the greater portion of her Plum areas are devoted to the production of prunes. Some pitted dried Plums have been prepared, but the small favor with which they have been received does not warrant the extra expense and labor of pitting. Some varieties are canned, and marketed in that way; but by far the greater portion of the real Plum product is marketed in the fresh (not canned) state both in local and distant cities. See *Prune*.

The Plum has an exceedingly wide range in California. It is not limited to any particular region of the state, but is thrifty and healthy on the immediate coast, in the interior and coast valleys and well up into the foothills. This is perhaps most strikingly shown by the fact that every county in the state, except two, perhaps (one being the city of San Francisco), contains Plum or prune orchards, or both. When it is considered that this covers an area of nearly 160,000 square miles, extending through 9½ degrees of latitude, a fair estimate of the adaptability of this fruit to varying conditions of soil and climate will be obtained. By choosing varieties ripening in succession, the California Plum season may be extended from May to December. It is not surprising, then, that the acreage devoted to Plums and prunes is one of the largest in the state, reaching a total of nearly 55,000 acres, an aggregate of nearly 6,000,000 trees, of which about seven-eighths are prunes. Alameda county leads in the acreage of Plums with 2,000 acres and Santa Clara in prunes with 8,000 acres. This great industry has developed since the discovery of gold. The early Mission plantings (1769–1823) included varieties of European Plums, a few of which were able to survive after the abandonment of the Missions in 1834 by reproducing themselves by suckers. One variety found at Mission Santa Clara was grown and marketed as the "Mission Prune" as late as 1870. The introduction of improved Plum varieties, however, dates back to 1851, when the first grafted fruit trees were brought to the state by Seth Lewelling from Oregon, where he and his brother had established nurseries in 1847. Prior to this introduction, however, the miners were supplied with fruit of the native Plums, and it is probable, therefore, that the need of introduced varieties of this fruit was not at first felt; hence, the adaptability of Californa to the production of the superior imported varieties was not recognized until some years later. The first importation of prune cions from France by the U. S. Patent Office in 1854 did not reach California. It was not until two years later that Pierre Pellier brought with him to San Francisco a small package of cions from the famous prune district of Agen, in France. Notwithstanding their long, perilous journey, the precious cuttings arrived in fairly good condition and were at once sent to Pellier's brother, Louis, who had already established a nursery and fruit garden in the Santa Clara valley, upon a portion of the site of the present city of San José. From these cuttings a number of trees were produced which succeeded admirably, and eventually were distributed through different sections of the state, but principally in the Santa Clara valley, which to this day remains the center of the California prune industry. In 1863 the first California-grown and -cured prunes were exhibited at the State Fair in Sacramento; but it was not until 1870 that planting on a commercial scale was begun. Through the seventies, and especially after 1878, numerous orchards were set out, until in 1881 some of the larger growers were producing between five and six tons of cured fruit. Since 1881 the growth of the prune industry has been marvelous, until now there are growers whose annual products reach hundreds of tons. The total output of the state was over 125,000,000 pounds in 1900, with many young trees not yet in bearing. In 1888 the United States imported 83,000,000 pounds of Plums and prunes. Since that time the importations have steadily declined until at present they are less than 800,000 pounds. The home product, the greater part of which, it is safe to say, comes from California, is thus gradually replacing the foreign-grown article.



1855. Voronesh Yellow, a Russian Plum of recent introduction. (× ⅔.) (See page 1372.)

Considerable difficulty was at first encountered in the selection of the proper grafting stocks. Naturally the native species were the first to suggest themselves and were used to some extent. But they were soon found to be unsatisfactory, mainly on account of their persistent habit of suckering, and dwarfing effect. The oso-berry, or False Plum, has also been used: it also dwarfs the trees and causes earlier ripening of the fruit. Many other American varieties have been tried as grafting stocks, but the persistent root-cutting brought about by the necessary summer cultivation in this state causes such heavy suckering that they have been abandoned. Peach, apricot and almond roots and suckers of the Mission Prune and Damson were used, but considerable difficulty was again encountered. The peach has proved the best. The apricot and almond can only be used in special cases, and double-working is almost always necessary; for, although some Plums "take" and grow on these stocks, the union is frequently imperfect, and instances are on record where the trees have broken off at the graft after reaching the bearing stage. The introduction of the Myrobalan or French cherry-plum (*Prunus cerasifera*) and its adoption as a grafting stock for Plums and prunes have greatly simplified matters for the California orchardist. It does not sucker, and experience has shown that in California it succeeds in low, moist lands, in comparatively dry soils and in stiff upland clay soils. It thus has become the all-round Plum stock in California; despite the dwarfing habit attributed to it by some, it has proved sufficiently free-growing in this state to suit all purposes, and to form a good foundation for full standard trees. On deep, mellow loam soils, specially adapted to the peach, that root is still preferred for Plum stock; but many varieties, e.g., the Columbia, Yellow Egg and the Washington, do not unite well with it, and cannot, therefore, be worked directly upon it. This is equally true of the almond, which is used in loose, warm or rocky foothill soils, and the deep, light valley loams where some excellent results with its use as a stock for the French and Fellenberg prune have been reported. The Myrobalan, then, is used almost entirely, except in special cases; but lately some murmurings of dissatisfaction with its lasting qualities (supposedly from the use of cuttings) have been heard; so that the question of an all-satisfactory grafting stock for the Plum in California may be still considered an open one.

There has been much discussion over the desirability of propagating the Myrobalan stock from cuttings or seeds. It is said that the roots from a cutting, being fibrous and coming from one point, cannot form a proper system for the support of the tree, though some old orchards worked on cutting roots are still thrifty. It must be admitted that the seedling gives a much more spreading and strong supporting system of roots. This has come to be generally recognized, and seedlings are now usually the rule. This is all-important in California, for there the roots of all plants must necessarily go deep for their moisture and nourishment. In fact, deep-rooting is the rule beyond all common expectation; thus almond roots the thickness of one's thumb have been found at a depth of 22 feet—one of the many instances of the characteristic conditions of California agricultural practice

Propagation is by both buds and grafts. The usual practice is to bud the young stock in July and August, and then in January and February following all those which have not taken can be grafted, thus securing two chances. When peach or almond is used as stock, budding alone is done, as these stocks have been found to take the graft poorly. The trees are not allowed to remain in nursery longer than one year after budding, and in many cases are set out the spring following, as "dormant buds." In California the necessity of deep and thorough preparation of the land before planting the young trees cannot be too strongly emphasized; for here the young tree must have every facility for getting its roots deeply and firmly established at the beginning, in order to enable it to withstand successfully the heat and drought of the long, arid summer. There has been much difference of opinion as to the proper distance for setting the trees apart and the mode of laying out the orchard. In early days the tendency was to rather close planting, in some cases as close as 16 feet; but experience soon demonstrated the undesirability of too close proximity, and later plantings were made with wider distances, until from 20 to 24 feet has come to be the rule. The laying out of orchards has caused much discussion, some asserting that the quincunx, hexagonal, and triangular systems secure better use of the land and allow better access to plow and cultivator than do the planting in squares. The square system, however, has come to be most generally used. The style of tree was the next point of contention among the growers; but experience soon decided in favor of the low-headed tree of the vase-form, with rather more branches than usual. The early, high-headed, sprawling trees have now practically disappeared from the California orchards, notwithstanding the strong objections at first offered against the low trees on the score of impeding easy cultivation. The prejudices have been overcome by the appreciation of the many advantages of a low, "stocky" tree, and the introduction of improved implements. The rule now is to cut back the young trees at planting to from 18 to 24 inches. Until the top is formed the stems are protected, by whitewashing or wrapping with burlap, from the hot afternoon sun. The first year from 3 to 5 branches are allowed to grow from the stem, and these used to form the main limbs of the tree. From this time the pruning is done according to the usual methods for the vase-form tree, with the exception perhaps that severer cutting-back is practiced at first in order to give strength and stockiness to the limbs. In California the Plum is a most remarkable grower, often sending out shoots 10 feet long in one season and prone to overbear; and when anything but the severest shortening-in system during the first two seasons, at least, is adopted, the trees very soon break down with their loads of fruit. This has been emphasized again and again in some of the earlier improperly pruned orchards, where even propping proved ineffectual; the branches break at the bearing of the props, and when they do not break are so badly damaged from sunburn (to which the bark is extremely sensitive) that the tree is irreparably injured. After the third or fourth season the growth of wood is much less and usually the pruning operations are confined to keeping the tree in shape, removal of dead or damaged branches and shortening-in the current season's growth to keep the young twigs in a vigorous growing condition and to prevent overbearing.

One interesting exception to the usual practice might be mentioned here. On some very rich, moist bottom-lands of the San Joaquin valley the long, slender branches are not cut back; in fact, they are encouraged by pruning back to the crown. The long, arching "canes" are allowed to remain until they have produced a crop (which they do in the second season with the greatest profusion), the ends resting upon the ground as the fruit gains weight. When these droop too low, they are cut back to the crown, when others will be produced to take their places. In this way enormous crops of fruit are produced on these lands, where, with ordinary treatment, the trees would run entirely to wood.

Thorough and persistent tillage is one of the first principles of the California orchardist, for with him the absence of summer rains makes the conservation of the winter rainfall an absolute necessity. Even in the summer-irrigated districts the soil is tilled and kept loose as soon as it is in proper condition, and no weeds allowed to rob the trees of the precious fluid. Up to three years ago, practically all the prune and Plum crop was produced without summer irrigation. Winter irrigation was often practiced and the water conserved in the soil by the usual methods of tillage. But the season of 1897–8 was one of the driest in the history of the state, with less than one-third of the usual amount of rainfall. The use of summer irrigation was in some instances the only salvation of the trees. The installation of pumping plants and irrigation systems thereby received a great impetus, until, to-day, many orchards of importance are thus equipped, and the use of summer irrigation bids fair to remain a permanent practice, at least in the production of prunes.

1856. Damson Plum (× ¾). (See page 1378.)

As yet the California Plum-grower (and this indeed is generally true for all deciduous fruits) has hardly felt the need of extensive fertilization. The soils of the arid regions generally possess such high intrinsic fertility, and the tree-roots have such great depths from which to draw the nourishment and sustenance, that thus far they have been able to produce the enormous crops taken from the land without replenishment of the natural supplies. In some of the older orchards, however, the need of fertilization is beginning to be felt. In a great many the main deficiency has been found to be vegetable matter, and, consequently, nitrogen. The extremely fine tilth which has been maintained has resulted in the destruction of all natural green growth and the "burning out" of the humus, and has necessitated the call for a green-manure crop. This problem is rendered more difficult in California by the fact that any such crop must be produced during the winter months and be ready to plow-in with the beginning of tillage in March; for no summer-growing crop can be allowed in the orchard. The matter has been under investigation at the California Experiment Station for some years, and after many trials of native and exotic legumes, three species of European lupins (*L. pilosus*, var. *roseus* and var. *cœruleus*, *L. angustifolius*), and the "hairy vetch" (*Vicia villosa*) have been found to be the most promising. From numerous analyses of California soils, Professor Hilgard has found them generally well supplied with lime and potash, with nitrogen and phosphoric acid not overabundant. It is, then, these latter which will have to be supplied first, and such has been the advice given to growers.

1857. Flowers of native plums.
Prunus Americana on the left; *P. angustifolia* on the right. (See page 1374.)

1858. Fruit-spurs of a Domestica Plum.
The letters indicate the termination of annual growths. (See page 1374.)

As mentioned above, the Plum has few serious enemies in California, and none which cannot be held in check by spraying and other treatment. Upon the leaves the Plum aphis and the canker worm have given some trouble. Lately, the "peach moth" has been found at work on the prune trees, but not to any serious extent. The trees, too, are sometimes subject to the attacks of scale insects; the black scale (*Lecanium olea*), apricot scale (*L. Armeniacum*), frosted scale (*L. pruinosum*) and pernicious scale (*Aspidiotus perniciosus*) being the most frequent; all of which, however, the California fruit-grower has learned to keep in check, and in some cases even to eradicate. The crown root-knot has also caused considerable trouble. The cause of this disease has been lately demonstrated by Toumey to be a "slime mold" (*Dendrophagus globosus*). Relief has been secured by cutting off the knots and painting the wounds with Bordeaux mixture.

In California some fruit is usually borne the third year; in the fourth a fairly profitable crop is expected; the fifth from 50 to 60 pounds per tree should be produced, which ought to double in the sixth, and after that from 150 to 300 pounds is the rule. These figures apply mostly to the prunes; many of the Plums are two or three years later in coming into full bearing. From 200 to 300 pounds are considered the average at full bearing in the Santa Clara valley. In some instances 600 and even 800 pounds have been produced, and a 6-year-old tree at Visalia (San Joaquin valley) is credited with 1,102 pounds of fruit in one season.

It would be impossible to enumerate a full list of the varieties actually in successful cultivation within the state. Such a list would probably include every noteworthy variety of Domestica Plum. Many, however, despite excellence of quality and flavor, are suited only for home-growing, or at most for local markets, on account of poor shipping qualities. For this reason the number of varieties planted on a large scale is being constantly reduced.

Experience has demonstrated the superiority of some varieties for certain climatic regions and general market conditions, and these have come to be recognized as standard. At the head of the list stands the Prune d'Agen, the originally introduced French prune, which has proved itself adapted to more varying conditions than any other variety, and is therefore perhaps the most generally planted variety of fruit in the state. For some time its identity as the true French prune was disputed; but from authentic samples submitted to them, French experts have declared it to be of the true d'Ente type of the Agen district, both in botanical characters and in sweetness and flavor. It is, of course, used chiefly for curing. In the same category belong the Robe de Sergeant, Imperial Epineuse, Silver and Sugar—all standard drying prune varieties. The Robe de Sergeant has been supposed by some to be a synonym of the Prune d'Agen, and is so considered in France; but in California it is grown as a distinct variety. The fruit is larger, usually more highly flavored, and has commanded higher prices in the San Francisco market. The tree, however, has not proved so widely adaptable, and is in disfavor in the coast valleys on account of defective bearing; in the interior it is more satisfactory. The Silver prune (an Oregon seedling of Coe Golden Drop) is also a defective bearer in some districts, and is used mostly in the preparation of "bleached prunes," for which it has proved quite profitable in some instances. It is sometimes marketed in the fresh state also. The Imperial Epineuse is a recently introduced French variety and is fast becoming very popular. So far as tried it has proved very profitable, especially in the Santa Clara valley, where many orchards have been grafted over to it. The fruit is very large and handsome, and actual analysis has shown it to contain 2 per cent more sugar than the ordinary French. It must be distinguished, however, from the "Imperial," a variety very much inferior in flavor and sweetness and not nearly so satisfactory. Luther Burbank's new Sugar prune (introduced two years ago) bases its claims upon superior sweetness and flavor, together with fair medium size. It has not yet been long enough under trial, however, to justify any remarks regarding its merits as a commercial variety. The German prune, Italian (Fellenberg), Golden prune, Hungarian (Pond Seedling), and Tragedy are varieties sometimes used for curing, but are frequently shipped green as "Plums." Of these the German is perhaps the most extensively used. The Italian succeeds well along the coast in places liable to fogs or sea winds, where the French is not at its best. It is valuable as a late variety, and is said to dry excellently, as does also the Golden, an Oregon seedling. The fruit of the Hungarian (Pond) is very hand-

1859. Plum rot.
The mummy Plums hang on the tree all winter. (See page 1374.)

some and showy, and is rated, on its style, a good seller in both the local and distant markets. The Tragedy—a seedling of the old Mission prune—belongs, together with the Clyman (a California seedling), Giant (Burbank's), Royal Hative, Simon and Peach, to the list of varieties most popular for early market—especially for eastern shipment. For canning, Coe Golden Drop and the Imperial Gage are the most popular. The Bradshaw, Columbia, Damson, Duane Purple, Green Gage, Jefferson, Washington, and Yellow Egg are all highly regarded, and planted more or less widely, as they suit the different climatic regions. Many of the Japanese Plums are represented in California orchards. The most prominent of these has been the Kelsey, the pioneer in this country of this class of fruits. In the interior valleys it is in some disfavor on account of its failure to develop color in these sections; but where it colors well it is profitable for shipping, and is highly regarded everywhere for domestic use; lately the Burbank and Wickson are largely replacing it. The Abundance and Red June are very popular for early shipment, while the Satsuma, Burbank, Normand, and Wickson (a Burbank hybrid) are all highly esteemed, especially for local market and domestic use.

During the past ten years elaborate investigations of the composition and food value of different fruits grown in the state have been carried on at the California Experiment Station. Many interesting results have been obtained, tending to show the vast influences of differing soil and climatic conditions upon the character and quality of the crops. Herein, too, may perhaps be found some explanation for the reason why the home-grown fruits have so readily displaced the foreign in the markets of our country; for the analyses have shown that our fruits are sweeter, more nutritious and contain less mineral matter than the European. In the average sugar percentages represented in the analysis of the juice, the figures are 18 per cent to 6.15 per cent or about as 3 to 1 in favor of the California prune. In albuminoids, or flesh-forming substance, the average percentages stand: for prunes, Californian 1.01 per cent, European .78 per cent; for Plums, Californian 1.13 per cent, European .40 per cent. Here it may be mentioned that the California analyses have shown the fig to stand highest in nutritive value, the apricot and Plum second, and the prune and orange about equal for third place. The figures for soil ingredients withdrawn show the California crop to contain less than the European, comparing as follows: European 6.30 pounds of ash per 1,000 pounds of fruit, Californian 4.86; for a crop of 30,000 pounds, 189 pounds for European and 145.80 for Californian. The amounts of important soil ingredients withdrawn per 1,000 lbs. in California are: of potash 3.1 pounds, lime .25 pound, phosphoric acid .95 pound and nitrogen 1.62 pounds. From these figures, the actual draft of the crop can be determined, and this, with the knowledge of the amounts of available plant-food in the soil, together with a consideration of its physical conditions, forms the basis of an intelligent judgment of fertilization requirements.

See Wickson's "California Fruits and How to Grow Them," the Reports of the California State Board of Horticulture, and the Reports and Bulletins of the California Experiment Station.

Arnold V. Stubenrauch.

PLUM, CHERRY. *Prunus cerasifera.*

PLUM, COCOA. *Chrysobalanus Icaco.*

PLUM, DATE. *Diospyros.*

PLUM, GOVERNOR'S. See *Flacourtia Ramontchi.*

PLUM, JAPAN. Properly *Prunus triflora;* improperly applied to the Loquat, *Eriobotrya Japonica.*

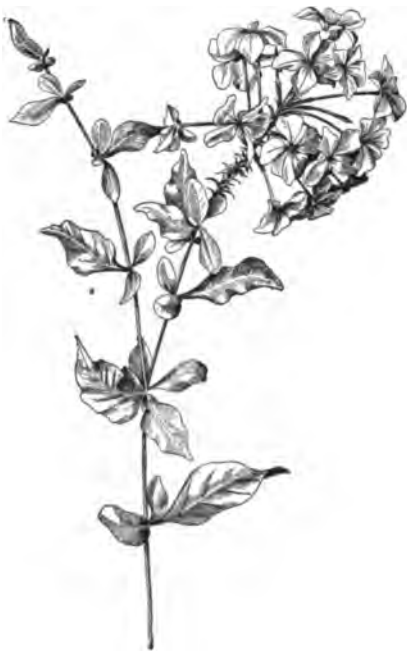
PLUM, MARMALADE. *Lucuma mammosa.*

PLUMBÀGO (from Latin for *lead;* because of some old tradition). *Plumbaginàceæ.* Leadwort. About 10 species of subshrubs or herbs, sometimes climbing, inhabiting warm countries, chiefly of Europe, Asia and Africa. Leaves usually alternate and entire, various: flowers spicate or racemose on the ends of the branches, gamopetalous, salverform, the tube usually slender, the corolla blue, violet, rose or white; calyx tubular, 5-toothed and somewhat angled, glandular; stamens 5, free from the corolla-tube: ovary attenuated at the top, the single style with 5 stigmas: fr. a membranaceous 5-valved capsule. For *P. Larpentæ,* consult *Ceratostigma.*

Two species of shrubby Plumbagos, *P. Capensis* and *P. rosea,* are deservedly well known. In the middle and northern states they are treated as greenhouse pot-plants and are usually turned out to flower in summer. They are readily propagated by cuttings taken either in the fall from plants growing in the open or in the spring from stock plants. They require an intermediate temperature.

A. *Fls. blue or white.*

Capénsis, Thunb. Fig. 1860. Climbing shrub but a straggling upright plant as grown under glass, somewhat glaucous, glabrous except in the inflorescence: lvs. scattered, oblong-ovate to oblong-spatulate, nearly or quite obtuse, narrowed into a short petiole: racemes relatively short, the fls. sometimes appearing as if umbelled: fls. azure-blue, with a very slender tube 1½ in. long and several times longer than the glandular-hairy cylindrical calyx-tube, the corolla-lobes obovate and phlox-like. S. Africa. B.M. 2110. B.R. 5:417. Gn. 44, p. 380; 46, p. 245; 48, p. 344; 58, p. 20. Var. **álba,** Hort., has white flowers.—A well-known greenhouse plant. Old plants turned into the soil in late spring in a sunny exposure bloom profusely until frost. Plants struck from fall cuttings also give good bloom the following summer, but younger plants usually do not bloom so well. Plants can be kept in a cellar during winter, or they may be grown under glass for spring and summer bloom. It is an excellent rafter plant. In southern California it climbs trees 15 or 20 ft. high if undisturbed.



1860. Plumbago Capensis (× ⅓).

Zeylánica, Linn. Half-climbing, glabrous except the inflorescence, which is glandular-hairy: lvs. ovate obtuse or acute, the base of the short-winged petiole clasping the stem: fls. white, shorter than in the above, the exserted part of the tube scarcely longer than the obovate retuse corolla-lobes, the calyx glandular-hairy. Tropics of Asia and Africa, and east to Australia and Hawaii. B.R. 32:23.—Little grown now, as it is inferior to the white-fld. form of *P. Capensis*. Distinguished from that species by its shorter fls. and different lvs.

scándens, Linn. Trailing or climbing, glabrous: corolla white with mucronate lobes, the tube twice longer than the glandular-hairy calyx-tube: lvs. ovate-lanceolate to oblong-lanceolate, pointed, stalked. Trop. Amer.

AA. *Fls. red.*

ròsea, Linn. (*P. sanguinea*, Hort.?). Stem zigzag, more or less climbing, glabrous even in the inflorescence: lvs. large, ovate-elliptic, the short petiole somewhat clasping: fls. purplish red, in long racemes, the corolla-lobes little if any exceeding the exserted part of the tube, the calyx glandular-hairy. S. Asia. B.M. 230. —Var. **coccínea**, Hook. (*P. coccinea*, Salisb.), is a form with larger scarlet fls. B.M. 5363. Gng. 1:183. This is the form chiefly cultivated. Like *P. Capensis*, this species is useful for summer bedding. It is also an excellent subject for winter blooming in pots. L. H. B.

PLUME GRASS. *Erianthus Ravennæ.*

PLUMÈRIA (Charles Plumier, 1646–1706, distinguished French botanist; wherefore the genus should have been spelled *Plumieria*). *Apocynàceæ*. This includes the showy tropical tree known as Frangipani, properly *P. rubra*. Plumerias are amongst the most fragrant of tropical flowers, vying in this respect with the jessamine, Cape Jasmine and tuberose. They have large, waxy, funnel-shaped fls. with 5 spreading lobes of white, yellow, rose-purple or combinations of the three colors. Choice specimens have been known to bear clusters 9 in. across, composed of more than 20 fls. each 3⅛ in. across. There are about 40 species, all tropical American, of which 2 kinds at present are offered in S. Calif. and 2 in S. Fla. They are considerably cult. in all tropical lands. The word Frangipani is supposed to be from the French, *franchipanier*, coagulated milk, referring to the tenacious white juice which exudes plentifully from the wounded plant. All species are likely to be called Frangipani. Plumerias are essentially summer-growing plants. Keep rather dry in winter. Prop. by cuttings in February or March.

In general, the lvs. are alternate, penninerved, the primary veins joined to a nerve running parallel with the margin: fls. in terminal 2–3-chotomous cymes: bracts usually large and covering the young buds but deciduous long before anthesis; corolla-tube cylindrical throughout; stamens included, near the base of the tube; disk wanting or fleshy and covering the tube of the calyx: ovules in many series: follicles 2. The species are much confused and imperfectly understood.

A. *Fls. more or less rosy.*

rùbra, Linn. Frangipani. Low tree or shrub: lvs. 6–8 in. long: cymes spreading: corolla-lobes broadly oval, longer than the tube. Mex. to Guiana and Ecuador; naturalized in West Indies. B.R. 10:780 (fls. chiefly golden, only the tips bright rose). B.M. 279.

AA. *Fls. chiefly white or yellow.*

B. *Lvs. narrow, oblong-linear.*

álba, Linn. Lvs. rounded or acuminate at top, revolute at margin, tomentose beneath; veins rectangular-transverse: fls. white. W. Indies. *P. hypoleùca*, Gasparr, is probably a color variety, with yellow flowers.

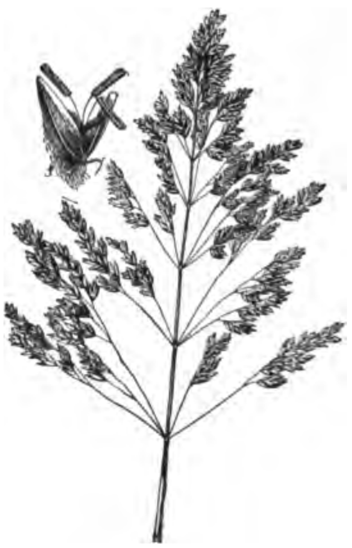
BB. *Lvs. wedge-shaped to lanceolate.*

acutifòlia, Poir. (*P. acuminàta*, Ait.). Lvs. acuminate, often 1 ft. or more long, 3 in. wide, broadly lanceolate, with a long tapering base: corolla-lobes oval. Mex. B.M. 3952 (fls. white, much flushed from the center with pale yellow). *P. acuminata* of B.R. 2:114, with its narrow oblong lobes and close, well-defined golden center, must be a different species. W. M.

PÒA (ancient Greek name for grass or fodder). *Gramíneæ*. About 100 species, natives of temperate and cold regions, mostly perennial grasses of low growth. Several species are cult. for forage or ornament. Spikelets 2–6-fld., in open panicles, empty glumes shorter than the fl.-glumes, awnless; fl.-glumes keeled on back, membranaceous, scarious margined, pointless, 5-nerved, often clothed with soft hair.

arachnífera, Torr. Texas Blue Grass. Culm 2–3 ft. high: panicle contracted, 3–8 in. long: spikelets ¼ in. long; first empty glume 1-nerved, second 3-nerved; fl.-glume copiously webby hairy at base. A native of Texas, where it is a valuable forage grass.—It propagates by rhizomes and forms a dense sod. Recommended as a winter pasture grass in the South. Easily distinguished from the other species by its contracted panicle and large spikelets.

praténsis, Linn. Kentucky Blue Grass. June Grass. Fig. 1861. Panicle pyramidal, open, usually 3–4 in. long: spikelets 3–6-fld., ⅛ in. long; lower empty glume 1-nerved, second 3-nerved: fl.-glume hairy at base: culm usually 1–2 ft. high, forming a sod with its copious rootstocks, its long, soft radical lvs. forming an abundance of foliage. Native in the cooler regions of the northern hemisphere.—A common pasture grass through the middle portions of the United States. Its most important horticultural use is for lawns, for which purpose its habit and aggressiveness are eminently adapted.



1861. June-grass—Poa pratensis (× ½). Flower enlarged.

triviàlis, Linn. Rough-stalked Meadow Grass. Resembles *P. pratensis*, from which it differs by having no creeping rootstocks, taller stems, branches of panicle more slender and spreading, usually only 2-fld. spikelets, and lateral nerves of fl.-glume much more conspicuous. Native of Europe, where it is a prominent pasture grass, and rather sparingly cult. in this country, where it is recommended for wet pastures. A variegated form is described. F.S. 16:1695.

compréssa, Linn. Known in the trade as Canada Blue Grass (though it is probably not native to Canada) and English Blue Grass, but the latter name is often applied to *Festuca pratensis*. Distinguished from *P. pratensis*, which it resembles, by its blue-green foliage, distinctly flattened culms, and its short and much contracted panicles. Spreads by rhizomes. Native of Europe and extensively naturalized in this country, being found in open and rather sterile soil.—It is of little value as a pasture grass except possibly on sterile soil.

nemoràlis, Linn. Wood Meadow Grass. A tufted perennial without running rootstocks. Panicle long and narrow, with short branches: culms 1–3 ft.: empty glumes 3-nerved, acuminate. Native of Europe and cooler parts of America.—It is recommended for pasture or lawn in shaded situations.

P. amábilis, Linn. See Eragrostis spectabilis.—*P. aquatica*, Linn. See Glyceria grandis. A. S. Hitchcock.

PODACHÆNIUM (Greek, meaning *foot-shaped akene*). *Compósitæ.* Two species of Mexican shrubby composites cult. chiefly for their large and fragrant lvs. The fls. are sometimes hidden under the foliage. The heads are about 1 in. across, with white rays and yellow disk, about 20 or more in terminal flat-topped clusters, borne in winter and spring. *P. paniculatum* is a rare and costly stove plant. The distinguishing feature of Podachænium is the shape of the akene, it being contracted at the base into a 2-winged stipe suggesting the shape of a foot.

Podachæniums may be cultivated much like Ixoras. They do best in a warmhouse. In the South they thrive in the open. They are useful for their large and sweet-scented foliage. Prop. by cuttings of half-ripe wood.

paniculàtum, Benth. (*Ferdinánda éminens*, Hort. *Zaluzània éminens*, Hort. *Cosmophýllum cacaliæfòlium*, C. Koch). Slightly branched, 9–15 ft. high: lvs. distant, long-stalked, roundish in outline, angled or with few, distant, shallow, wide-angled teeth, scabrous above, pubescent beneath. Mex., Guatemala. R.H. 1862, p. 110.

H. A. SIEBRECHT and W. M.

PODALÝRIA. See *Baptisia.*

PODOCÁRPUS (Greek *pous*, *podos*, foot, and *karpos*, fruit; alluding to the conspicuous fleshy foot-stalks of most species). Including *Nagèia*, *Prumnópitys* and *Stachycárpus*. *Coniferæ.* Ornamental evergreen trees or rarely shrubs, with alternate or sometimes opposite and often 2-ranked sessile or short-stalked lvs., small fls., the staminate catkin-like and yellow, the pistillate greenish and inconspicuous, and with rather small, berry-like fr. borne on usually much thickened fleshy foot-stalks of dark purple or purplish violet color. They are but rarely cult. in this country and only adapted for the southern states and California, except *P. alpina*, which is the hardiest and may probably thrive as far north as Philadelphia, or even farther. They grow best in well-drained loamy soil. In the North they are sometimes grown as pot-plants in greenhouses on account of their handsome foliage; a sandy compost of loam and peat will suit the potted plants. Prop. by seeds or by cuttings of almost ripened wood under glass; they are also sometimes grafted on any of the species which can be had in quantity.

The genus has more than 40 species, chiefly in tropical and subtropical mountains of S. America, W. India, Asia, Africa and Australia. Resinous trees, with linear to elliptic entire lvs.: fls. monœcious or diœcious, axillary or subterminal, solitary or in spikes; the staminate catkin-like, consisting of spirally disposed 2-celled anthers; the pistillate consisting of a scale enclosing the ovule, with several bracts at the base, which become usually much thickened at maturity, and form a fleshy receptacle bearing at the top the globular or ovoid drupe- or nut-like seed: cotyledons 2. Some species with the fls. in spikes and the fr. without fleshy receptacle are referred by some botanists to Prumnopitys (Stachycarpus). Many species are valuable timber trees in their native countries, and the fleshy seed-stalks of some are eaten.

A. *Lvs. 3–8 in. long.*

macrophýlla, Don. Tree, attaining 50 ft., with ascending branches: buds and young unfolding lvs. pinkish: lvs. alternate, linear-lanceolate, sometimes falcate, obtusish or acute, bright green and glossy and with a prominent midrib above, pale beneath, 3–5 in. long, about ⅓ in. wide: fls. diœcious, staminate ones cylindric, ¾–1½ in. long: fr. ovoid, ⅓–½ in. long, greenish, bloomy, borne on a fleshy dark purplish violet receptacle. Japan. S.Z. 2:133.

Japónica, Sieb. Closely allied to the preceding and probably a variety of it. Of lower growth: buds whitish, young lvs. greenish: lvs. linear-lanceolate, acute, 4–8 in. long: fls. and fr. unknown. Cult. in Japan. —Sometimes *Cephalotaxus pedunculata*, var. *fastigiata* is cult. under this name.

AA. *Lvs. ¾–1¾ in. long*

nubigena, Lindl. Tree or shrub in cultivation: lvs. spreading, crowded, linear-lanceolate, acute and mucronate, pungent, somewhat revolute at the margins, dark green and with a prominent midrib above, with 2 white bands beneath, 1–1¾ in. long: fls. diœcious, the staminate clustered, ⅓–1 in. long: fr. ovoid, ⅓ in. long, on a fleshy receptacle, very short-stalked. Chile. P.F.G. 2:162. G.C. III. 10:171.

alpina, R. Br. Shrub or small tree, attaining 15 ft., with spreading branches: lvs. indistinctly 2-ranked, linear to linear-oblong, obtuse, mucronulate, dark green, grooved or flat above, pale green beneath, ⅛–¾ in. long: fls. diœcious, the staminate solitary or clustered, about ⅛ in. long: fr. small, on a fleshy receptacle. Australia.

P. Andìna, Poepp. (Prumnopitys elegans, Phil. Stachycarpus Andina, Van Tiegh.). Tree, attaining 20 ft., with upright or somewhat spreading branches: lvs. indistinctly 2-ranked, linear, dark green above, slightly glaucous beneath, ⅓–1½ in. long: fls. in spikes; receptacle not fleshy. Chile.—*P. Bidwilli*, Hoibr.=P. Totara.—*P. Chilìna*, Rich. (P. saligna, Don). Tree, attaining 60 ft., allied to P. macrophylla: lvs. linear-lanceolate, acute, slightly falcate, 3–4½ in. long: staminate fls. clustered, about 1 in. long. Chile, Peru.—*P. Chinénsis*, Wall. (P. macrophylla, var. Maki, Sieb. & Zucc.). Closely allied to P. macrophylla, but a lower tree or sometimes shrub, with somewhat spreading branches: lvs. shorter, 1¾–3½ in. long: staminate fls. shorter. China; cult. in Japan. S.Z. 2:134. R.H. 1848:41. —*P. coriàcea*, Rich. Tree, attaining 50 ft., with spreading branches; allied to P. macrophylla: lvs. lanceolate, acuminate, 2–4 in. long: fr. ovoid. Jamaica. Sometimes Cephalotaxus drupacea is cult. under this name. —*P. elongàta*, L'Hérit. Tree, attaining 70 ft., with whorled spreading branches; allied to P. macrophylla: lvs. linear-lanceolate, acute, about 2 in. long: staminate fls. solitary or clustered, about ¾ in. long: fr. globose, ⅓ in. across. S. Africa.—*P. Jamaicénsis*, Hort.=P. Purdieana.—*P. Koraiàna*, Sieb.=Cephalotaxus pedunculata, var. fastigiata.—*P. Nagèia*, R. Br. (Nageia Japonica, Gærtn.). Tree, attaining 90 ft., with spreading, sometimes pendulous branches: lvs. mostly opposite, ovate to oblong-lanceolate, short-acuminate, 2–3½ in. long, bright green and glossy: fr. ¾ in. across, subglobose. Japan. S.Z. 2:135.—*P. neriifòlia*, Don (P. macrophylla, Wall., not Don). Tree, allied to P. macrophylla, with whorled spreading branches: lvs. lanceolate, acuminate, dark green above, slightly glaucous beneath, 4–8 in. long: staminate fls. solitary, 1 in. or more long. Himalayas. B.M. 4655. F.S. 8:768.—*P. Purdieàna*, Hook. Tree, to 120 ft., with whorled horizontal branches: allied to P. macrophylla: lvs. oblanceolate, obtuse, mucronulate, bright green, 2–5 in. long, ¾ in. wide. Jamaica.—*P. salìgna*, Don=P. Chilina.—*P. spicàta*, R. Br. (Prumnopitys spicata, Mast.). Tree, attaining 80 ft.: lvs. 2-ranked, linear, obtusish, sessile, ¼–½ in. long: fls. in spikes; receptacle not thickened. New Zealand.—*P. taxifòlia*, Kunth. (Prumnopitys taxifolia, Mast.). Tree, attaining 60 ft., with spreading branches: lvs. 2-ranked, linear, acute or obtuse, abruptly narrowed into a short petiole: fls. in spikes: no thickened receptacle. Peru, Columbia.—*P. Totàra*, Don. Tree, attaining 90 ft. with spreading branches: allied to P. alpina; lvs. linear, acute or acuminate, ½–1½ in. long. New Zealand.

ALFRED REHDER.

PODÓLEPIS (Greek, *foot* and *scale;* referring to the unusual fact that the involucral scales have a foot-stalk or claw). *Compósitæ.* About 16 species of Australian herbs with yellow, pink or purple rays, a few of which are cult. as half-hardy annuals, growing 6–12 in. high and bearing fls. which are chiefly interesting as representing an intermediate stage between the common type of composite with showy rays and the "everlasting flowers," like Helichrysum, in which the rays are aborted and the showy parts are the stiff involucral scales. In Podolepis the involucral scales are generally colored, but are thin and nearly transparent, and overlap one another instead of standing out like petals. The genus belongs to an unfamiliar group of composites from Australia and the Cape.

The following species are annuals with linear or lanceolate lvs. and hemispherical involucres ½–¾ in. in diameter. They need a porous soil with full exposure to the sun, and they also do well in pots. See *Annuals.*

A. *Color of rays yellow.*

B. *Involucral bracts acute.*

canéscens, A. Cunn. (*P. affinis*, Sond.). Rarely much exceeding 1 ft.: involucral bracts slightly or not at all rugose; claws with broad scarious margins: rays 3–4-lobed, slightly longer than the disk-fls.

BB. *Involucral bracts acuminate.*

aristàta, Benth. (*P. chrysántha*, Endl.). Often exceeding 1 ft.: involucral bracts not rugose, usually ending in a rigid point or awn, the claws of the inner ones narrow and glandular: rays longer than the disk-fls., 3-4-lobed. R.H. 1857, p. 263.

AA. *Color of rays purple or lilac.*

grácilis, Grah. Often exceeding 1 ft.: involucral bracts obtuse; claws narrow, glandular: rays entire or 2-lobed, ½ in. long: pappus not thickened upwards. B. M. 2904 (disk-fls. mostly purple, some yellow).

W. M.

PODOPHÝLLUM (from Tournefort's *anapodophyllum*, duck's-foot-leaf; from a fancied resemblance in the foliage). *Berberidàceæ.* May Apple. Mandrake. Nearly every American boy knows of a colony of Mandrakes and has eaten May Apples. The "apples" are yellowish, egg-shaped fruits about 2 in. long, and have a rather mawkish taste. The leaves are very distinct, being shaped like a round shield with 5-7 lobes. Mandrakes have two kinds of lvs., the big solitary ones, and the smaller ones in pairs. The large centrally peltate leaves have no flower underneath. The flowers are nodding white wax-like cups which spring from the fork of the stem. They have a rather unpleasant smell. There is a white butterfly which comes at nightfall and probably pollinates the May Apples. One sometimes finds Mandrake blossoms that seem to be double, but just as he is about to pick the extra petals, a butterfly flies away.

Some parts of the Mandrake plant are emetic and poisonous. Extract of Podophyllum is common in drug stores. Mandrakes are common in rich woods and copses throughout the eastern United States. A colony of them is most desirable for a wild garden. They are offered by several dealers in hardy herbaceous perennials. They are of easy culture, requiring deep, rich soil and partial shade. They are useful only for spring effects, however, as the foliage dies down by midsummer or before. Later-growing vigorous perennials, as *Polygonatum giganteum*, may be associated with a planting of Mandrake, to occupy the ground in the later part of the season. *P. Emodi* requires a moister situation, and some prefer a peaty soil for it. Prop. by division or by seed. What we call the Mandrake is not the Mandrake of Old World history and romance, for which see *Mandragora.*

Podophyllum is a genus of four species,—one American, one Himalayan and two from China. Hardy perennial herbs: sepals 6, petal-like; petals 6-9; stamens as many or twice as many as the petals; pistil 1 (rarely several): berry with many seeds, which are inclosed in fleshy arils.

A. *Fruits yellowish.*

peltàtum, Linn. May Apple. Mandrake. Fig. 837, Vol. II. Height 1-1½ ft.: lvs. dark green, nearly 1 ft. across, 5-7-lobed, each lobe 2-cleft: fls. about 2 in. across. Also called Wild Lemon and Hog Apple. B.M. 1819. Gn. 21, p. 127. D. 131. B.B. 2:92. Nature's Garden 186. —Blooms in April and fruits in May.

AA. *Fruits deep red.*

Emòdi, Wall. Lvs. 3-5-lobed: fls. white or pale rose: fr. large as a hen's egg, brilliant red. Himalayas. G. C. II. 18:241.—The foliage is a fine bronzy red in early spring.

F. W. Barclay and W. M.

PODOSTÍGMA (Greek words referring to the fact that the stigma has a foot or stalk). *Asclepiadàceæ.* This includes a half-hardy tuberous-rooted perennial herb which grows a foot high or less in low pine barrens from N. C. to Fla. and bears in summer small greenish yellow fls. The genus is closely allied to Asclepias, and is distinguished by having the hoods remote from the anthers at the base of the long column, while in Asclepias the hoods are approximate to the anthers. See Chapman's Flora of the southern U. S. and Gray's Syn. Flora of N. Amer.

pubéscens, Ell. Lvs. opposite, linear-lanceolate, nearly sessile: peduncles terminal and axillary, umbellately several-fld. The only species.—Adv. by Gillett in 1881, but presumably not hardy north.

POGÒNIA (Greek, *beard;* alluding to bearded labellum). *Orchidàceæ.* A genus of hardy terrestrial orchids: mostly small, perennial herbs, with erect slender stems: fls. solitary or in racemes; sepals and petals free, erect or ascending; labellum sessile, with broad base, spurless, with longitudinal ridges. Pogonias are delicate plants requiring care in planting. The woodland species should have rich leaf-mold, with deep shade; the swamp species require peat or suitable light, rich soil, moist yet not wet. All the species are preferably planted in spring.

A. *Sepals and petals nearly equal in length.*

B. *Lip crested.*

ophioglossoides, Ker. Stem 8-15 in. high, slender, 1-3-lvd.: lvs. 1-3 in. long, lanceolate or ovate: fls. solitary or in pairs, fragrant, pale rose, subtended by a foliaceous bract. June, July. In meadows and swamps, U. S. and Japan. B.R. 2:148. G.F. 10:485. V. 2:269; 11:229.—This seems to be the only species that can be grown with success. It thrives in wet moss in boxes of sphagnum. Usually it is better to transplant from the wild each year than to attempt to propagate the plants. Sometimes they can be colonized in wet meadows.

BB. *Lip not crested.*

péndula, Lindl. Root tuberous, sometimes clustered: stem 3-8 in. high, bearing 2-8 small ovate lvs. and 1-7 pale purple fls. Aug., Sept. Rich woods, Canada to Fla. and west. B.R. 11:908. B.B. 1:467.

AA. *Sepals longer than the petals.*

C. *Stem bearing single leaf.*

divaricàta, B. Br. Stem 1-2 ft. high, slender, bearing a solitary fl.: fl. 1 in. long; sepals dark; petals flesh-colored; lip as long as petals, greenish, veined with purple. July. Swamps, N. J. to Fla. B.B. 1:468.

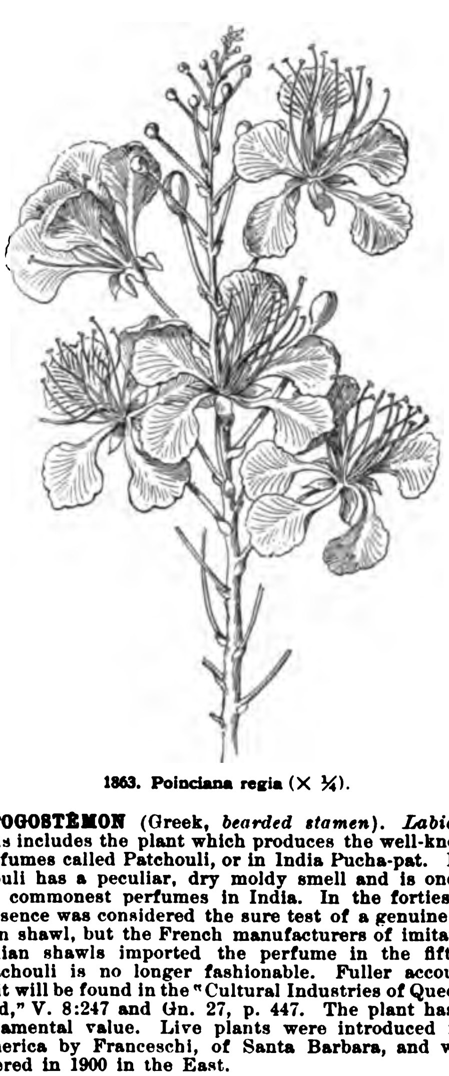
CC. *Stem bearing whorl of lvs. at the top.*

verticillàta, Nutt. Stem 8-15 in. high, bearing whorl of 5 obovate sessile lvs. at its summit: fl. solitary, ter-

1862. Royal Poinciana—Poinciana regia.

minal; sepals 1½–2 in. long, linear, dark purple; petals nearly 1 in. long, linear. May, June. Moist, rich, shaded positions, Ont. to Wis. and Fla. B.B. 1:468.

Heinrich Hasselbring and F. W. Barclay.



1863. Poinciana regia (× ¼).

POGOSTÊMON (Greek, *bearded stamen*). *Labiàtæ.* This includes the plant which produces the well-known perfumes called Patchouli, or in India Pucha-pat. Patchouli has a peculiar, dry moldy smell and is one of the commonest perfumes in India. In the forties its presence was considered the sure test of a genuine Indian shawl, but the French manufacturers of imitation Indian shawls imported the perfume in the fifties. Patchouli is no longer fashionable. Fuller accounts of it will be found in the "Cultural Industries of Queensland," V. 8:247 and Gn. 27, p. 447. The plant has no ornamental value. Live plants were introduced into America by Franceschi, of Santa Barbara, and were offered in 1900 in the East.

Pogostemon is a genus of about 30 species, 24 of which are distinguished in Flora of British India 4:631. Herbs or subshrubs: lvs. opposite, rarely in 3's: fls. small, in solitary or panicled spikes formed of many dense whorls; calyx subequally 4–5-toothed; corolla-tube exserted or included; limb sub-2-lipped; lobes 4, lower usually longest; stamens 4, exserted, straight or declinate; filaments usually bearded; anther cells confluent.

Heyneànus, Benth. (*P. Patchoùly,* Pellet). Patchouli Plant. Herb, 2–3 ft. high: lvs. long-stalked, ovate, acute, acuminate or obtuse, crenate, simply or doubly toothed: spikes terminal and axillary, forming a panicled inflorescence: whorls usually separate, forming interrupted spikes: fls. whitish, tinged purple. India.

POINCIÀNA (M. de Poinci, governor of the Antilles in the seventeenth century). *Leguminòsæ.* Small, mostly broad-topped unarmed trees, with large and graceful bipinnate lvs. with numerous small lfts. and with no stipels and inconspicuous stipules: fls. very showy, orange or scarlet, in large, corymbose racemes, not papilionaceous, the 5 petals clawed and eroded or even fimbriate on the margin, the stamens 10 and free and exserted: fr. long and flat. There are 2 or 3 species of Poinciana, all native to the oriental tropics. The genus has been confounded with Cæsalpinia, but the calyx-segments are valvate, whereas they are strongly imbricate (or overlapping) in Cæsalpinia. The *P. pulcherrima,* known as Barbadoes Pride and Bird-of-Paradise Flower, is *Cæsalpinia pulcherrima. P. Gilliesii* is *C. Gilliesii. P. elata,* Linn., native to India, Arabia and tropical Africa, is planted in the Old World, but is not in the American trade. It reaches a height of 20–30 ft., with the petals scarcely exserted beyond the calyx.

règia, Boj. Figs. 1862, 1863. Royal Poinciana. Peacock Flower. Flomboyant. Rapid-growing tree, reaching 20–40 ft., and making a wide-spreading picturesque top: lvs. 1–2 ft. long, with 10–20 pairs of pinnæ, each pinna with numerous oval leaflets: fls. 3–4 in. across, bright scarlet (upper petal striped with yellow and more cuneate), the obovate petals very prominently clawed (or narrow below): pod 6 in. to 2 ft. long. Madagascar. B.M. 2884.—Now a popular tree in frostless countries, as in S. Fla., S. Calif., Bermuda, and the West Indian Islands. It is deciduous. One of the most striking of tropical trees. Sometimes seen under glass in the North. *Cæsalpinia pulcherrima* is often confounded with it; but that plant is a shrub or at most only a small tree, with strongly overlapping calyx-segments in the bud, smaller fls., and very long-exserted stamens.

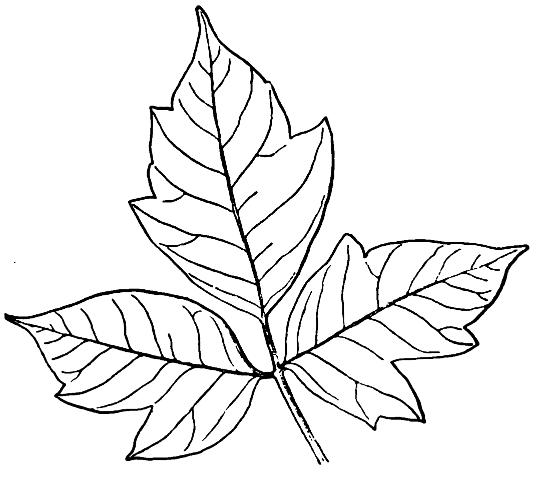
L. H. B.

POINSETTIA. *Euphorbia pulcherrima.* **Annual P.** is *E. heterophylla.*

POIREA is a catalogue error for Poivrea.

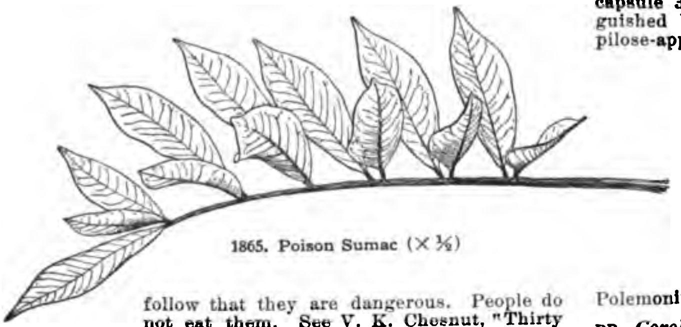
POISON BERRY, *Cestrum.* **P. Dogwood,** *Rhus venenata.* **P. Elder,** *Rhus venenata.* **P. Hemlock,** *Conium maculatum.* **P. Ivy,** *Rhus Toxicodendron.* **P. Oak,** *R. Toxicodendron.* **P. Sumac,** *Rhus venenata.*

POISONOUS PLANTS. Very few plants are poisonous to the touch. The only ones in the northeastern states are Poison Ivy and Poison Sumac. The former is a root-climbing vine (*R. Toxicodendron*) with ternate leaves (Fig. 1864), and the latter is a tree-like bush (*Rhus venenata*) with pinnate leaves and entire leaflets (Fig. 1865). Poison Ivy is sometimes confounded with Virginia Creeper, but the latter usually has 5 leaflets, it is a much taller vine and it climbs by means of tendrils (Fig. 1866). Poison Ivy is much commoner than Poison Sumac. The latter is confined to swamps. There are



1864. Leaf of Poison Ivy (× ½).

many remedies for poisoning by Poison Ivy. One of the best is an alcoholic solution of sugar of lead. Extract of grindelia (sold at drug-stores) is sometimes used. Many plants, even amongst the common garden species, are poisonous when eaten, but it does not follow that they are dangerous. People do not eat them. See V. K. Chesnut, "Thirty Poisonous Plants of the U. S.," Farmers' Bull. 86, U. S. Dept. Agric.; and Bull. 20, Div. of Botany.



1865. Poison Sumac (× ½)

POIVREA (N. Poivre, 1719–1786; intendant of Mauritius). *Combretàceæ.* This includes a South African shrub with orange-red fls. cult. in S. Fla. The genus is referred by Bentham and Hooker to Combretum, a large genus containing some handsome plants that are little known. Poivrea differs from the other Combretums chiefly in the convolute cotyledons. Generic characters of Poivrea (from Flora Capensis): calyx 5-lobed; petals 5; stamens 10, protruded: ovary 2–3-ovuled: fr. oval or oblong or 5-winged; seed solitary, pendulous, 5-angled. Mostly climbing shrubs: lvs. opposite or alternate, entire: spikes axillary and terminal.

bracteòsa, Hochst. Unarmed shrub 8–10 ft. high: lvs. opposite or in 3's, 2½–3 x 1–1¼ in.: petals clawed, reddish, 4 lines long: fr. oval, indistinctly 5-angled. Called "Hiccup-nut" in Cape Colony.

POKER PLANT. *Kniphofia.*

POKEWEED. See *Phytolacca.*

POLEMÒNIUM (ancient name, probably not from Greek *polemos,* war, but rather the philosopher Poleman). *Polemoniàceæ.* This includes the JACOB'S LADDER, *P. cæruleum,* an old-fashioned inhabitant of cottage gardens, which owes its popular name to the regular manner in which the numerous leaflets are arranged on the long leaves. It is a hardy perennial herb, growing 1–3 ft. high and bearing 5-lobed, bell-shaped fls. of blue or white, and about an inch across. Probably the finest species, however, is the plant known to all gardeners as *P. Richardsonii,* which is a form of *P. humile* that has doubled or trebled in size in cult. A fine specimen of *P. Richardsonii* may have a terminal cluster 6½ in. across and 5 in. deep, with 24 fls. each 1¼ in. across. *P. confertum* differs from all others in the great density of its inflorescence, and by connoisseurs in alpine plants may be regarded as the finest of the genus. Most of the yellow-fld. forms are disappointing. Polemoniums are of easy culture in any deep, rich, loamy soil. *P. cæruleum* and *P. reptans* do well in partly shaded places not too dry. They are easily raised from fall-sown seed. Also prop. by division. They are impatient of soil on the leaves, as is likely to occur during rain. Flowers of *P. Richardsonii* are fragrant and fine for cutting.

Polemonium is a genus of about 10 species of herbs natives of the north temperate zone and the mountains of Mexico and Chile. Perennials, rarely annuals, tall or dwarf, usually viscid, often with a creeping rhizome which is thick or slender: lvs. alternate, pinnatisect: fls. blue, violet, white or yellowish; calyx increasing after anthesis; corolla shortly funnel-shaped, broadly bell-shaped or subrotate; lobes obovate: ovules 2–12; capsule 3-valved. Closely allied to Gilia and distinguished by the declinate stamens and the filaments pilose-appendaged at the base.

A. *Color of fls. blue or white.*

B. *Corolla-tube longer than lobes: inflorescence a dense head.*

confértum, Gray. Sticky, smelling of musk, 9–18 in. high, from a tufted rootstock: lfts. very small and so crowded as to seem whorled: fls. honey-scented, deep blue, ½–1 in. long; corolla narrowly funnel-shaped; filaments naked or nearly so and not dilated at base. Rockies and Sierras. Gn. 10:48. G.C. II. 24:12; III. 27:237.—Intermediate between Polemonium and Gilia.

BB. *Corolla-tube shorter than lobes: inflorescence open.*

C. *Plants with thickened rootstocks: lfts. seldom ½ in. long.*

hùmile, Willd. (*P. Richardsonii,* Grah.). Low, slender plant from somewhat creeping rootstocks: lfts. 15–21, 2–6 lines long: fls. bell-shaped, blue or purplish. July, Aug. Arctic regions. B.M. 2800 (yellow eye). G.C. II. 19:793. B.R. 15:1304 (small fls., white eye).—It has the odor of ripened grapes.

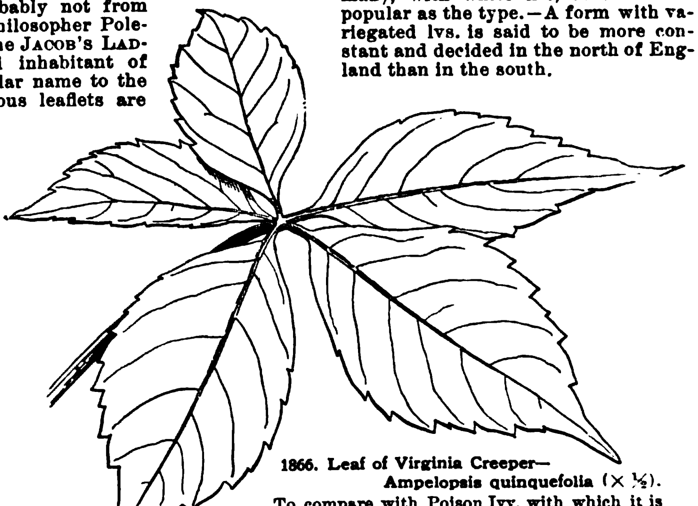
Var. **pulchéllum,** Gray. Differs in having smaller fls. ranging from violet and lavender to nearly white and in the viscid pubescence, which is minute. Arctic coast. *P. pulchérrimum,* Hook., B.M. 2979, is a more viscid, diffuse and smaller-fld. form with narrower corolla-lobes.

CC. *Plants with slender rootstocks or roots: lfts. larger.*

D. *Height 1–3 ft.: lfts. numerous.*

E. *Herbage scarcely if at all scented.*

cærùleum, Linn. JACOB'S LADDER. CHARITY. Fig. 1867. Height 1–3 ft.: lfts. 9–20 lines long: fls. blue, numerous in a thyrse, 1 in. or less across; style exserted. May, June. Wet or moist ground, N. Asia, Eu., N. Amer. Var. **álbum,** Hort. (*P. álbum,* Hort. Bridgeman), with white fls., is almost as popular as the type.—A form with variegated lvs. is said to be more constant and decided in the north of England than in the south.



1866. Leaf of Virginia Creeper—Ampelopsis quinquefolia (× ½).
To compare with Poison Ivy, with which it is sometimes confounded.

EE. *Herbage strong-scented.*

foliosissimum, Gray. More viscid than *P. cæruleum,* leafier, with broader lfts. and the style not exserted. Fls. commonly white or cream-colored, rarely violet. Rocky Mts. Cult. in 1890 by Vick, but perhaps never offered in America.

DD. *Height 1 ft. or less: lfts. fewer, 5-15.*

réptans, Linn. Slender, weak and diffuse but never creeping; foliage not viscid or glandular: fls. light blue, ½ in. across, in a sort of loose panicle. Open woods, N. Y. to Ala., west to Mo. and Minn. Apr., May. B.M. 1887.—Said to be an easy prey to snails, especially in winter, when they attack the rootstocks.

Var. **Himalayànum**, Baker (*P. grandiflòrum*, Hort., not Benth. *P. cærùleum*, var. *grandiflòrum*, J. W. Manning). Fls. 1½ in. across, lilac-blue or darker, the rounded lobes nearly ½ in. across; calyx and axis of panicle very hairy. Himalayas. Described in G.C. III. 1:766.

AA. *Color of fls. yellowish or flesh color.*

B. *Fls. salmon or flesh color.*

cárneum, Gray. Rather stout, 1-2 ft. high: lfts. 5-15, often 1½ in. long: fls. fading to purplish, 1-1½ in. across. Mountain woods, Calif.—Offered by Pilkington, Oregon, 1892, but probably not in cult. now. Closely allied to *P. reptans*.

BB. *Fls. yellowish.*

pauciflòrum, Wats. Height 1-2 ft.: lfts. 16-24, about 1 in. long: fls. tubular, the tube 1-1¾ in. long, much longer than the lobes. Mex.—The color is said to be a good clear yellow, tinged red outside, but they are probably only cream-colored at best. Offered by J. W. Manning in 1892, but subsequently dropped.

F. W. Barclay and W. M.

POLIÁNTHES (name discussed below). *Amaryllidàceæ*. Tuberose. Every one knows the waxy white Tuberose, a single flower of which will scent a whole house. It belongs to a genus of one, or at least of very few, species. It is placed in the sub-family of which the Century Plant (Agave) is the type, but differs in not having thick, fleshy spiny leaves. From its nearest allies (Prochnyanthes, Beschorneria, Doryanthes) it is distinguished as follows: perianth white; tube long, narrowly funnel-shaped, curved; segments short, subequal; stamens affixed at the middle of the tube, not exserted: ovary 3-celled, free at apex: stigmas 3, ovate, falcate: fr. crowned by the persistent perianth; seeds flat. Baker, Amaryllideæ, 1888.

The name Polianthes was given to the Tuberose by Linnæus in 1753 in his Species Plantarum, which is usually taken as the beginning of nomenclature. Unfortunately he wrote "Polyanthes" in an earlier work, published in 1737. This was probably a slip of the pen. Many writers have changed the spelling to Polyanthus, supposing that Linnæus had in mind the idea of "many-flowered," from *polys* and *anthos*. Others have supposed he derived it from *polis*, a city. It seems probable, however, as Bentham and Hooker suggest, that Linnæus had in mind *polios*, "shining," "white," which is much more applicable to the Tuberose than are the other derivations. Consult *Polyanthus* for other meanings of the word Polyanthus.

The name "Tuberose" is derived from *tuberosa*, this plant being the tuberous hyacinth as distinguished from the bulbous hyacinth. The name therefore is *tuber-ose*, not *tube-rose*.

tuberòsa, Linn. Tuberose. Figs. 1868, 1869. Rootstock tuberous: basal lvs. 6-9 to a stem, linear, 1-1½ ft. long, spotted red-brown on back: stem 2-3 ft. high, with 8-12 reduced lvs.: fls. 1½-2½ in. long, borne in pairs in a lax spike; segments ½-¾ in. long. Mexico. B.M. 1817. B.R. 1:63. R.H. 1882, p. 429. F. 1881, p. 27. Gn. 47, p. 330.

"*Polyanthus maculata*" figured in Blanc's catalogue is, judging from the picture, a species of Agave of the section Manfreda, and not *Polianthes maculata*, Von Martius. Von Martius' name is not accounted for by Baker, but according to the original description it is a plant with a tuber-like bulb: stem 1-2½ ft. high: lvs. lanceolate or obovate-lanceolate, marked with round or elliptic spots: fls. sessile, in a simple spike, greenish yellow, spotted purple. It is probable that *P. maculata* of Von Martius belongs to another genus. W. M.

There are only two objections to the Tuberose: its odor is too powerful for many people, and, like the calla lily, it has funereal associations. Hence fashion has deserted it, at least in America. Nevertheless 6,000,000 bulbs a year are now grown in America, and a fifth of them (1,200,000) are used in this country. The Tuberose is more popular than ever in Europe. It will always be a standard florists' flower, for the people love it, whatever fashion may decree.

1867. Polemonium cæruleum.

Tuberoses in the Home Garden.—Although every florist has Tuberoses and they are cheaper now than ever, thousands of people like to have a Tuberose growing in their own garden. The bulbs are best procured in spring and planted outdoors after all danger of frost is over. The common tall-growing double sort is preferred for this purpose, largely because the fls. open better during the unfavorable dry weather which we often have in October. Cover the bulb about an inch with fine, light soil. A bulb planted out June 1 will bloom in late summer or fall. Before frost comes take up the bulbs and store them over winter in a rather warm (50° F.), dry place where no frost will touch them. If kept moist and cool during winter the bulbs are likely to rot at the center. Sound tubers will always be green at top or show some sign of life at the growing point. The others are not worth planting. In the far North where the season is short, Tuberose bulbs may be started indoors about the middle of May, the tubers being placed on a layer of damp moss.

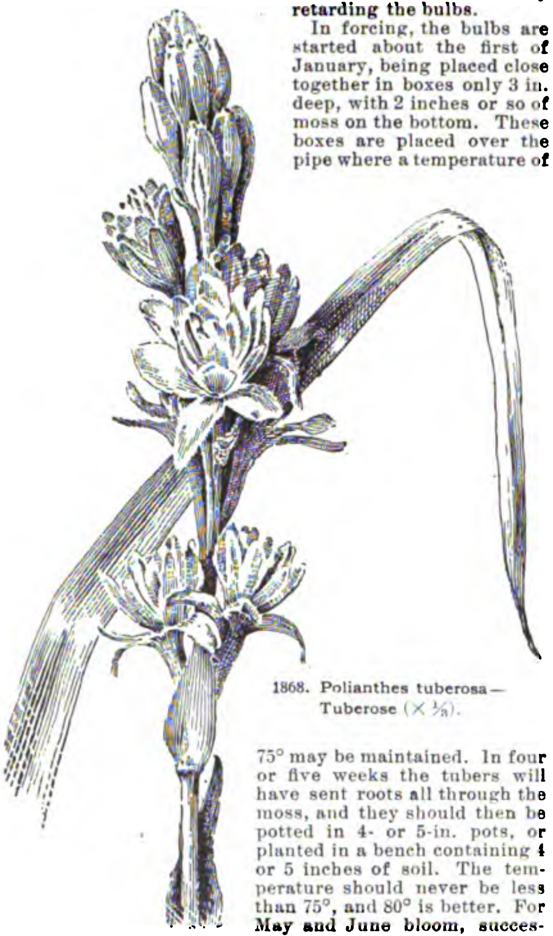
Historical Sketch.—The first date of interest in the history of a garden favorite is usually the time when live plants first reached European gardens and showed signs of popularity. The Tuberose reached Europe some time before 1530. Though a native of Mexico, it came to Europe from India and, like many other tropical American plants of high importance, it was long supposed to be native to the Orient. Thus as late as 1629 Parkinson calls it *Hyacinthus Indicus*. The plant was brought to Europe by a Catholic priest, and the priests refused all applications for bulbs until 1594. The first double-flowered form was secured from seed about 1780–1790 by one de la Cour of Leyden, Holland, who for many years destroyed all his surplus bulbs in order to be the sole possessor of the double-flowered Tuberose.

The Tuberose reached the zenith of its fame about 1870, while the equally waxy Camellia and the formal Dahlia were still fashionable. In 1865 Peter Henderson sold $1,500 worth of Tuberoses from a glasshouse 10 x 100 ft. Wm. Scott, of Buffalo, writes that he can remember when it was as much trouble to procure a dozen Tuberose bulbs "as it would be now to get a young kangaroo from Tasmania." "Twenty-five years ago," he continues, "the Tuberose was a flower of the first importance, but how are the mighty fallen!"

In recent times the greatest improvement in the Tuberose is represented by the Pearl, a dwarf variety which originated with John Henderson, of Flushing, L. I., in 1865. It was introduced by Peter Henderson in 1867. Being a foot shorter than the common double type, it is the best form for greenhouse culture; also the fls. are more numerous and nearly twice the size.

Tuberose Culture by Northern Florists.—Tuberoses are chiefly grown by American florists for summer and fall bloom. It is a very difficult operation to force Tuberoses so as to bloom from January to March, but they can be forced with comparative ease to bloom from April to June. Also flowers may readily be secured for November and December by retarding the bulbs.

In forcing, the bulbs are started about the first of January, being placed close together in boxes only 3 in. deep, with 2 inches or so of moss on the bottom. These boxes are placed over the pipe where a temperature of 75° may be maintained. In four or five weeks the tubers will have sent roots all through the moss, and they should then be potted in 4- or 5-in. pots, or planted in a bench containing 4 or 5 inches of soil. The temperature should never be less than 75°, and 80° is better. For May and June bloom, successional batches may be planted at intervals of three or four weeks after New Years. The last crops will usually be the best.



1868. Polianthes tuberosa—Tuberose (× ⅓).

For November bloom the bulbs are retarded in some cool, dry place until the middle of August. The second batch should not be planted until the middle of September. This will produce December bloom.

For summer blooming in the open ground, the form known as the "Tall Double" is the most to be preferred. In this variety, the flowers open better and are a clearer and purer white than those of the Pearl. The Albino is a single white Tuberose blooming in July and August. It is a very floriferous variety, with flowers that lack the brown or stained tint of some of the older forms. The odor is less powerful, and therefore more pleasant, than that of the ordinary Tuberose.

Tuberose Culture in Europe.—In Europe there is demand for Tuberoses the year round. The Natal-grown bulbs arrive in September, while the American-grown bulbs do not reach Europe until December or even January. The former are forced, and the latter retarded. In an excellent review of Tuberose culture in Gn. 47:330, "Southron" says: "No manure is needed in the soil, otherwise it will tend to produce a superabundant leaf-growth; but manure water will, if given after the spikes are fairly started, greatly assist the bulbs in developing the flowers. In private gardens the one great trouble oftentimes is that of red spider." * * * "The Tuberose makes one of the prettiest buttonhole bouquets imaginable." * * * "Where many suckers appear around the crown-growth, it is a good plan to thin them out, otherwise the flower-spike will be weakened. Personally, I have had a preference for growing the Tuberose in the long pots, oftentimes termed hyacinth pots; these take less room and are quite large enough."

Peter Henderson & Co.

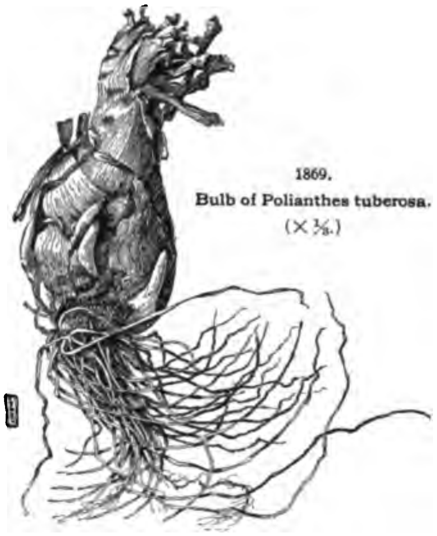
Commercial Production of Tuberose Bulbs.—Tuberose bulbs were formerly grown extensively for commercial purposes in Italy, and are grown in a small way at the present time in South Africa, though the African bulbs are not in much favor with European florists because the bulbs ripen and are shipped in midsummer and a great number fail to bloom. None of the foreign-grown bulbs are imported into the United States and, owing to the superiority of the American-grown Tuberoses and the low price at which they are produced, they have driven the Italian-grown bulbs out of the American market. About 80 per cent of the American crop is exported. Practically the entire product of this country is grown in a limited area in the southeastern part of the state of North Carolina.

Tuberose bulb culture in the southern states was first attempted by F. A. Newbury in Duplin county, N. C., in 1868. Beginning with a dozen bulbs, he propagated stock until, in 1888, the yield was about 1,000,000 bulbs. During these years the crop was cultivated entirely by hand and consequently was very expensive. The prices received at first were $40 per 1,000, but since then prices have declined each year as quantity increased until, in 1888, bulbs were selling at $6 to $8 per 1,000. In 1888 H. E. Newbury, a brother, bought out the business, and he and J. F. Croom, another grower who had propagated considerable stock, extended the business very greatly, introducing less expensive methods of cultivation. By use of the horse-plow they were enabled to greatly reduce the selling price and stimulate demand for bulbs, so that the crop of 1900, within a radius of 20 miles of one point (Magnolia, N., C.), amounted to 6,000,000 bulbs, selling at wholesale in car-load lots at $3.50 per 1,000. This yield is secured from over 300 acres.

The soil in the section around Magnolia, which seems so especially adapted to the culture of Tuberose bulbs, is a light, sandy surface with a porous clay subsoil at a depth varying from 2 to 8 ft., with the bottom lands a dark but porous sandy formation. In wet or rainy seasons the bulbs thrive best on the uplands, and in dry seasons best on the dark moist bottoms, though they withstand equally well a great deal of wet or drought.

The crop is set in April, after the soil has been thoroughly pulverized. It is then laid off in rows or furrows 22 in. apart; into these is sowed fertilizer at the rate of 600 lbs. to the acre. About 400 lbs. of cotton-seed meal and 20 bus. of good wood ashes to the acre have given the best results, though any reliable fertilizer with a good percentage of potash is all right.

The fertilizer is thoroughly mixed with the soil by running a plow with point only in the furrow. Into this the sets or "seed," as they are called, are carefully placed upright by hand and covered with plow. Usually the bulblets are rather slow in starting off, and just as they begin to break through, the soil, which has become hardened or crusted, is raked or broken up. This assists the plant in getting up and also destroys any growth of grass which may have started. Cultivation is done chiefly with a cotton plow, using the sweeps to put earth to the plant and destroying any grass in the rows. Tillage is required every two weeks until August: an occasional hoeing between plants by hand is necessary in order to loosen the soil and destroy weeds and grass not reached by the plow. The crop is matured and gathered between Oct. 15 and Nov. 15. The tops by this time have reached a length of 18 or 20 in.; these are cut off at the ground with a sharp weeding hoe and the bulbs are plowed out very much as potatoes are. Women then lift out and shake off the earth, and the offsets are removed by hand. These sets are the seed-stock for next season. The bulbs are graded as to size, carried to curing houses, and by some placed on shelves to dry or cure out. The bulbs must be stirred or have their position changed every few days to prevent mold and rot. This stirring wears or breaks off the roots and tops of a good percentage of the bulbs, making a less sightly bulb, though not injuring its flowering property. The better and more modern way is to gather them by the roots in bunches of about 10, tie them together with a small cord and hang them upon frames, walls and overhead of house and allow them to cure without disturbing them during the process of drying. While this would seem a rather expensive way, it really costs but a few cents per thousand, being done by small negro children at nominal wages. In recent years artificial heat of 80°–100° by means of furnace and flues similar to those used in tobacco barns has been introduced, to hasten curing. Four to eight weeks are required to properly cure the bulbs for shipping, so that the first shipments begin to move about Dec. 1 to 10. Before shipment the bulbs are again sorted in order to get out any undersized bulbs that may have been overlooked; they are also counted and packed in paper-lined barrels, holding from 700 to 1,300, the number varying with size of bulbs and size of barrels. About 200 bbls., or 150,000 to 175,000 bulbs, constitute a car-load. The bulk of the exports go through New York dealers, several of whom handle half a million or more each. A few are exported direct.



1869. Bulb of Polianthes tuberosa. (× ⅓.)

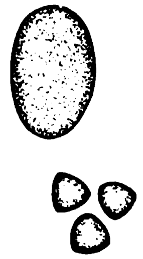
Dwarf Pearl is the variety mostly grown. This sends up a flowering stem about 15 inches long, the blossom being double. The Tall Double is similar, except that the flowering stem is longer, about 24 inches or over. The White or Orange Flower has a long stem, with the blossom single or resembling the blossom of an orange tree. The Albino, a freak from the Pearl, is a dwarf single or orange-flowered variety, but its tendency in other latitudes is to go back to the double type, and consequently is likely to disappoint the grower who expects a single blossom. The foliage of all the above is a rich green. The variegated-leaved variety has a beautiful stripe of golden or silver hue on the outer edge of the foliage. The blossom is single and the habit is dwarf. The Tuberose is treated as an annual and has to be replaced each season.

A "number one" bulb (referring to size) is not less than 4 inches in circumference and measures up to 6 inches and over; "mammoth" bulbs are 6 to 8 inches in circumference. Only a very small part of the crop will attain such measurement. A "number two" bulb is less than 4 in. and over 3 in. in circumference, and while in the South these will bloom as well as the larger bulbs they are not much sought by the northern dealers. The Tuberose is a rather slow grower; hence in the North, where the frosts are much earlier than South, it is likely to get caught before its spike of bloom matures. To succeed in getting flowers in the North they should be started in pots under glass or in rooms free of frost in April and transplanted to open ground in early June. The soil should be deeply pulverized. Select a sandy loam if possible, and fertilize with manure containing a good percentage of potash. Keep the earth about the plant thoroughly stirred and do not let the plant suffer for moisture. H. E. Newbury.

POLLEN. All gymnosperms (conifers, etc.) and angiosperms (true flowering plants) normally reproduce by means of seeds. For the fertilization of the ovule, in order that seed may result, the intervention of the pollen is necessary. The "dust of the flower" is therefore of far more interest to the horticulturist than this old popular name would imply. Studies in hybridization and self-sterility have long made evident the practical importance of a knowledge of pollen. Every plant provides for the production of this substance, and usually in definite pollen-bearing leaves termed stamens. The stamens are organs of the flower, and as essential as the carpels. The pollen is produced in definite sacs or compartments of the anther, located usually at the tip of the stamen; and when the pollen is ripe, or mature, the fine grains are set free in quantity by the rupture of the inclosing sacs. The abundance of pollen produced may suggest wasteful management of the plant's resources; but a liberal supply of this substance is necessary. Although it requires but a single one of the small grains to fertilize a single ovule and produce a seed, pollen-grains are produced often a thousandfold more abundantly than ovules. The best offspring are produced when cross-fertilization occurs, and in the transfer of pollen from plant to plant it is only a small part which can reach its proper destination. There are many chances and such great losses that abundance of pollen is a necessary provision.

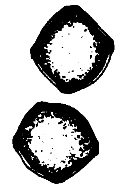
In general, flowers are pollinated by the wind and by insects; that is, pollen is transported by these two agencies. Flowers principally dependent upon the wind for pollination are termed anemophilous, while those visited by insects are designated entomophilous. These distinguishing terms may also be applied to the pollen itself. Anemophilous pollen is of a more or less spherical form, readily yielding to the wind, and correlated with this is a dry and inadherent outer surface. Such is the case, for example, in the various families to which the oak, willow, grasses, pine, etc., belong, all of which plants are devoid of any stock of brilliant color or rich odors that might attract bug, moth, butterfly, or bee. The pollen of the pine has even developed bladders, so as to be borne more lightly upon the wind. On the other hand, those plants largely dependent upon the visits of insects for pollination may have the pollen-grains provided with some kind of spines, ridges, furrows, or viscid coatings that they may the more readily adhere to hairy limbs or other surfaces of the insect which may come in contact with them. Here, then, is to be found a reason for the beauty and specialization of external wall. In entomophilous pollen the elliptical form of grain predominates, but the general shape is extremely various; and the plants producing such pollen are usually provided with beauty of flower, fragrance, or other insect attraction.

In order that the pollen which has been transported to the stigma may be effective, it must be healthy. Experiments have shown that weak, poorly nourished orchard trees often produce ineffective pollen. The nature of the season may also have great influence upon its character, continued rains causing great losses by preventing the maturity of this product as well as by mechanical injury and by precluding the winged carriers. Most plants have some special provision for the protection of the pollen against rain; that is, either by the closing of the flower under moist conditions, or by the location of the anthers in a sheltered tube, under projecting hairs, lobes, or other corolla appendages.



1870.

Pollen grains of Primula obconica (below) and salvia. Magnified.



1871.

Pollen grains of Browallia. Magnified.

1872.

Oddly marked Pollen grain of Schaueria flavicoma. Magnified.

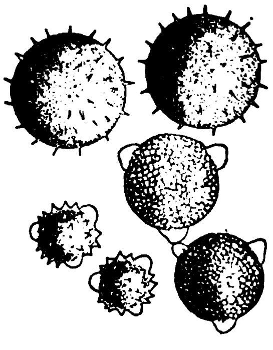
The individual particles of pollen are in the form of delicate grains only readily visible in some quantity, as in powdery masses. At the time when they are set free, the grains are generally entirely distinct from one another, to be blown about by an accidental wind or carried by visiting insects. In some cases, however, the grains are bound together loosely or by means of delicate glutinous threads (Rhododendron); they may be closely united into 4's (heath family); or the whole tissue of an anther or its divisions may remain intact as pollinia (some orchids, milk-weed, etc.). A particular species of plant will produce pollen quite constant in form and attire; but an aggregation of cultivated varieties originated from a single species may show considerable variation in this regard. Nevertheless, form, size, color, surface markings, texture of wall, and translucency of contents are not fixed qualities even for related genera or species. See Figs. 1870-3 for different forms of pollen.

When the healthy pollen of one plant falls upon the ripe stigma of a plant of the same species, the grains germinate in the sugary excretion of the stigma by the protrusion of a tube which penetrates the style and effects fertilization as described under *Fertilization*. Furthermore, it is well known that while the flowers of many plants may be readily fertilized by their own pollen, the offspring are stronger when pollen from another plant or another variety have had access to the flower. Sometimes pollen from a foreign variety is absolutely essential to the best fruit formation. This is particularly true of certain varieties of the pear. A poor quality of fruit can be prevented only by growing together different varieties. Again, although a plant may readily pollinate itself, yet the pollen from another plant or variety may be prepotent over its own. That is to say, if the plant be pollinated by its own pollen along with that of a foreign variety, that of the foreign variety will usually effect fertilization. This can be explained only on physiological grounds, and at present merely from a theoretical point of view. Any pollen penetrates and effects fertilization because it is attracted, first by substances in the style, and later by the egg-cell itself. When a foreign variety is prepotent it is so because it is more readily attracted, due, we may say, to a greater difference of potential between the two elements, the two elements from the same plant being more in equilibrium and less markedly attractive. As regards pollen from a foreign species, it seems to be the rule that hybridization does not occur so readily, and we must then assume that the differences have become so great as to cause repulsion.

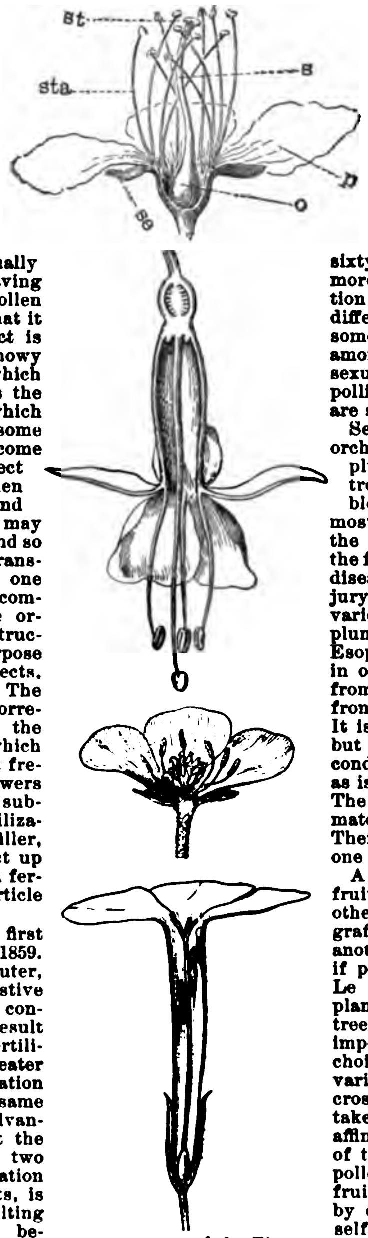
The detailed development of pollen is highly interesting and instructive on morphological grounds, but in this place a very brief account of the formation of the grains will suffice. The developmental phases in *Bignonia venusta* will serve as an example. A cross-section of the young flower-bud will show that in the anther-sac regions, semicircular layers of large well-nourished cells (called archesporial cells) are differentiated. These cells divide and the layer increases in extent, yet in this case it is always only one cell in thickness. When these cells have finally attained considerable size and provided themselves with a thick wall, they divide more or less simultaneously; and then each of these daughter-cells divides again by a division following quickly upon the first. Each cell has then formed four new cells within its original walls. The new cells remain thus united in 4's until each is provided with a stout wall of its own, and then they separate. Each cell is then an immature pollen-grain, and technically a spore, that is, exactly homologous with the microspores of the vascular cryptogams. As a rule, before these pollen-grains are set free, another change occurs denoting maturity. This consists in the division of the nucleus of the spore in such a way that two cells of unequal size result (in some conifers several small cells are formed). On germination the large cell, which now incloses the smaller, protrudes the tube which penetrates the style; whereas the nucleus of the small cell divides into two, and one of these fuses with the egg-cell in the ovule, thus fertilizing it.

Allied topics are discussed under *Pollination*, *Self-sterility*, *Flower*, and *Hybrids*. B. M. Duggar.

POLLINATION. In botanical usage, Pollination is the transfer of pollen from the anther to the stigma. In horticultural usage, particularly with reference to orchard fruits, the term is often applied in a general way to designate all the influences concerned in the setting of fruit. Aside from those cases in which the stamens and pistils are so intimately associated that the pollen falls directly on the stigma, flowers are pollinated mainly in two ways: by wind and by insects. The grasses, sedges and pines afford examples of wind-pollinated plants. The flowers of wind-pollinated plants are usually inconspicuous and without nectar or fragrance. They produce a great abundance of light, dry pollen, which is wafted away by the slightest breeze and is often carried many miles by a strong wind. The pistils of these plants are usually long and feathery, and thus are well adapted to catch the flying pollen. For the benefit of those who are uninformed in botany, it may be said that pollination is concerned primarily with the "essential organs" of the



1873. Pollen grains of Abutilon striatum (above). Bedding geranium (Pelargonium hortorum, on right). Chrysanthemum (on lower left). All magnified.



1874. Structure of the Flower, to illustrate Pollination.

1. Top.—The structure of a plum blossom: *se.* sepals; *p.* petals; *sta.* stamens; *o* ovary; *s.* style; *st.* stigma. The pistil is composed of the ovary, style and stigma. It contains the female part. The stamens are tipped with anthers in which the pollen, or male part, is borne. The ovary, *o*, ripens into the fruit.

2. Fuchsia, showing ovary at *a*, 3 stamens (one is removed) and the projecting style.

3. Buttercup, showing many small pistils in the center and stamens surrounding them.

4. Bottom.—Phlox, showing the 3-parted stigma, and the stamens included in the tube.

flower,—the stamens and pistils (see *Flower;* also Fig. 1874). The stamens bear the pollen in their anthers, and they die after the pollen is shed. The pistils bear the ovary or seed-case, the style, and the stigma. On the stigma the pollen falls. In some plants these organs are separated in different flowers or even on different plants.

The flowers of insect-pollinated plants, on the other hand, are usually characterized by being showy and having nectar or fragrance, or both. The pollen is more or less moist or sticky, so that it is not easily blown away. An insect is attracted to these flowers by the showy colors and the perfume, two things which bespeak the presence of nectar. As the insect reaches down for the nectar, which is near the bottom of the flower, some parts of its body are almost sure to become dusted with pollen. When the insect visits another flower some of this pollen may be brushed upon the stigma, and a fresh supply received. This pollen may likewise be carried to another flower, and so on. Thus "cross-pollination," or the transfer of pollen from the anthers of one flower to the pistil of another, is accomplished. Many flowers, notably the orchids, have special modifications of structure apparently developed for the purpose of securing cross-pollination by insects, and preventing self-pollination. The bodies of some insects also have corresponding adaptations which insure the cross-pollination of certain flowers which they are in the habit of visiting most frequently. This correlation between flowers and their insect visitors has been the subject of extended observation. "Fertilization of Flowers," by Hermann Müller, contains a bibliography of the subject up to 1886. For the distinction between fertilization and pollination, see the article *Fertilization*, page 579.

The value of crossing to plants was first clearly proved by Charles Darwin in 1859. From the observations of Kölreuter, Sprengel, Knight, and his own exhaustive experiments, Darwin showed that continued self-fertilization is likely to result in inferior offspring; while cross-fertilization, within certain limits, gives greater vigor to the offspring. Cross-fertilization between different flowers on the same plant has usually no appreciable advantage. The reason for this is that the plant resulting from the union of two unlike parents, as in cross-fertilization between flowers on different plants, is more variable than the plant resulting from self-fertilization or crossing between different flowers on the same plant, and hence has better chance of fitting itself to new conditions. Plants are endlessly modified to secure cross-fertilization and avoid self-fertilization. The principal means by which this end is gained are: (1) Special contrivances in the structure of the flower, which favor cross-pollination. (2) A difference in the time at which the pollen matures and the stigma becomes receptive in the same flower (dichogamy). This condition is very noticeable in some varieties of orchard fruits. The prematurity of the pistil is more common than the prematurity of the stamens. (3) Self-sterility, which is the inability of a flower to set fruit with its own pollen. It might be expected that self-sterility would naturally result from continued cross-pollination by the first two means, but there is little evidence that the self-sterility now noticeable in plants was developed in this way. Self-sterility is not usually due to a deficiency in the pollen or to defective pistils. The pollen grains often germinate on the stigma, but fertilization does not take place. The embryological reasons for this are not clearly understood. About sixty species of plants are known to be more or less self-sterile. (4) The separation of the sexes in different flowers or on different individuals. It is thought by some that there is a gradual evolution among some kinds of plants toward unisexuality, and that adaptations for insect-pollination, dichogamy and self-sterility are steps in this process.

Self-sterility is common in varieties of orchard fruits, particularly in pears and plums, and in grapes. Whenever isolated trees or large blocks of a single variety blossom full, year after year, but drop most of the fruit before it is half-grown, the trees may be self-sterile, provided the failure cannot be attributed to fungous disease, insect attack, frost or other injury. Familiar examples of self-sterile varieties are: Wild Goose and Miner plums, Kieffer and Bartlett pears and Esopus Spitzenburg apple. Self-sterility in orchard fruits does not usually result from defectiveness of pollen or pistil, but from a lack of affinity between the two. It is not a constant factor in any variety, but seems to be as easily influenced by the conditions under which the tree is grown as is the size, shape or color of the fruit. The adaptation of a variety to soil and climate has much to do with its self-sterility. Therefore, a variety is often self-sterile in one place and self-fertile in another.

A self-sterile tree often may be made fruitful by planting near it trees of another variety to supply pollen, or by top-grafting part of the tree with cions of another variety. Thus, Miner bears freely if planted with De Soto, and Kieffer with Le Conte. No benefit is derived from planting in an orchard of one variety new trees of the same variety. There are two important points to be considered in the choice of a pollinizer. First, the two varieties must blossom together, so that cross-pollination by wind or insects may take place. Second, there must be an affinity between the two, so that the pistils of the self-sterile variety will accept the pollen of the other and develop into good fruit. Such affinity can be determined only by experiment. In a large orchard of a self-sterile variety which is valuable for market, every third or fourth row should be the pollinizer.

Orchard Pollination, however, is a larger problem than the detection of varieties which are inclined to be unfruitful when planted alone, and discovering what are the best pollinizers for them. Experiments in crossing and observations in orchards have indicated that nearly all varieties of orchard fruits, whether self-sterile or not, will produce better fruit with pollen other than their own. The Baldwin apple will usually bear good fruit if planted alone, but it will bear better fruit if the right variety is planted with it. The probability is that most of our leading commercial varieties commonly planted in large blocks will produce enough better fruit by a judicious intermingling of one or two other varieties to more than offset the slight inconvenience in orchard management occasioned by this mixing. The chief economic problem for the experimenter, therefore, is to determine what commercial varieties may be planted together with best results; and the rational course for the fruit-grower is to practice mixed planting on the basis of such experiments.

S. W. FLETCHER.

POLYANTHUS. In common speech Polyanthus means the florists' flowers supposed to be derived chiefly from *Primula elatior* or its allies. The "Polyanthus Narcissus" of trade catalogues is one of the forms of *Narcissus Tazetta*, an old synonym of which was *Narcissus Polyanthos*. Polyanthus may also mean the tuberose, Polianthes, which see. There is no genus known as Polyanthus.

POLYBÒTRA. See *Acrostichum*.

POLYCALÝMMA. See *Myriocephalus*.

POLÝGALA (Greek, *much milk;* from the old idea that some species increased the flow of milk). *Polygalàceæ.* MILKWORT. Polygala is a genus of over 200 widely distributed species. Sepals 5, the two lateral ones, or "wings," much larger than the rest and colored; petals rarely 5 and alternate with the sepals, or commonly reduced to 3 (an odd anterior one and a dorsal pair), united below into a dorsally cleft tube; lower petal, or keel, concave, often crested or beaked; stamens 8; filaments more or less connate into a tube: capsule 2-celled, wing-margined or wingless; seeds solitary in the cells. Monographed by Chodat in Mém. Soc. Phys. Hist. Nat. Genèv. (1, p. 2, No. 2). For the American species, see Robinson, Gray's Syn. Fl. Vol. I, p. 449.

In the culture of Polygalas there are three points of view. There are hardy and tender species, and the latter are sometimes cultivated under glass, sometimes outdoors in the South, as in S. Calif. Of the hardy group, *P. paucifolia* is excellent, because of its fringed flowers. Of the European kinds *P. Chamæbuxus* is the best, and var. *purpurea* is probably the best form of it. Referring to our native species, F. W. Barclay writes: "Polygalas are mainly plants of low moist lands, and the majority of species are best grown in sandy peat, or any rather light soil, in partially shaded positions not given to severe dryness at any season. Seed may be sown in fall or early spring. *P. lutea* is perhaps our handsomest native species, but it is not advertised for sale. It needs sunlight." *P. paucifolia* can be prop. by division.

There are 40 or more North American species, but most of them are not showy plants and they offer little inducement to the cultivator. Some of them—as recorded below—are offered by dealers in native plants, but these are not necessarily the best. The only species that are generally known to cultivators are exotic.

The Cape species are much-branched shrubs, 2–4 ft. high or more, with large fls. borne in subterminal racemes. In the good old days when heaths were much grown for exhibition 14 colored plates of Polygalas appeared in the Botanical Magazine, 13 in the Botanical Cabinet, and 7 in the Botanical Register. Ernest Braunton writes that "*P. myrtifolia* and its varieties are very commonly cult. in Calif., particularly the one known in gardens as *P. Dalmacina* or *P. Dalmatiana;* this flowers all the time and is very popular." The popularity of *P. Dalmaisiana* in Calif. is an example of the persistence of a good thing in gardens, though almost unknown to botanists. This name is not to be found in any of the standard authorities, except Nicholson's Dictionary. Nor is it known to be advertised in America. The spelling Dalmatiana shows that some gardeners have thought the name a geographical one. The plant was named after M. Dalmais, a French gardener, who raised it from seed in 1839. It was described, with colored plates, in Rev. Hort. 1844:193 and the Florist's Journal 1846:177, and Garten Flora 5:161. In the first-named place it is stated to be a hybrid between "*P. grandiflora* and *P. cordifolia*." In modern nomenclature this probably means *P. myrtifolia*, var. *grandiflora* × *P. oppositifolia*, var. *cordata*. The pictures, however, do not seem to show any trace of the latter parent. As known in the trade, *P. Dalmaisiana* is a free-blooming plant with rosy or purplish flowers. H. D. Darlington writes that he has received it under three or four different names, and adds: "It makes a good pot-plant, but is somewhat bare of foliage. It blooms from the ends of the ripened growth. It can be had in flower almost any time. The odd color and shape of the flowers, and its free blooming, make it very attractive. It roots only fairly well from cuttings. Usually it propagates better by layering. Put in rich loam with well-rotted manure. It will stand considerable frost."

A. *Plants hardy.*
B. *Fls. showy, ½–¾ in. long.*
C. *Keel beautifully fringed* .... **paucifolia**
CC. *Keel merely 4-lobed* .... **Chamæbuxus**
BB. *Fls. not showy.*
C. *Inflorescence a spike: fls. not pedicelled* .... **Senega**
CC. *Inflorescence a raceme: fls. pedicelled* .... **polygama**
AA. *Plants tender.*
B. *Habit shrubby, erect, 2–3 ft. high or more.*
C. *Lvs. opposite* .... **oppositifolia**
CC. *Lvs. alternate.*
D. *Lateral petals 2-cut* .... **myrtifolia**
DD. *Lateral petals not 2-cut* ...... **virgata**
apopetala
BB. *Habit dwarf, 1 ft. or less high* ..... **amatymbica**

paucifòlia, Willd. FLOWERING WINTERGREEN. GAY-WINGS. FRINGED MILKWORT. FRINGED POLYGALA. Fig. 1875. Trailer, 3–6 in. high: upper lvs. clustered, ovate, 1½ in. long; lower lvs. distant, small and becoming mere bracts at the base: fls. bright rosy purple, varying to white, 1–4 in the axils of the upper lvs. or appearing terminal. May, June. New Brunswick to Winnipeg, and Ga. Prefers moist woods and sphagnum bogs. B.M. 2852 (petals white). B.B. 2:361.—Var. **álba** was once offered by F. G. Pratt, Concord, Mass., where it grows wild. One sometimes finds violet-fld. forms. The species bears cleistogamous fls.

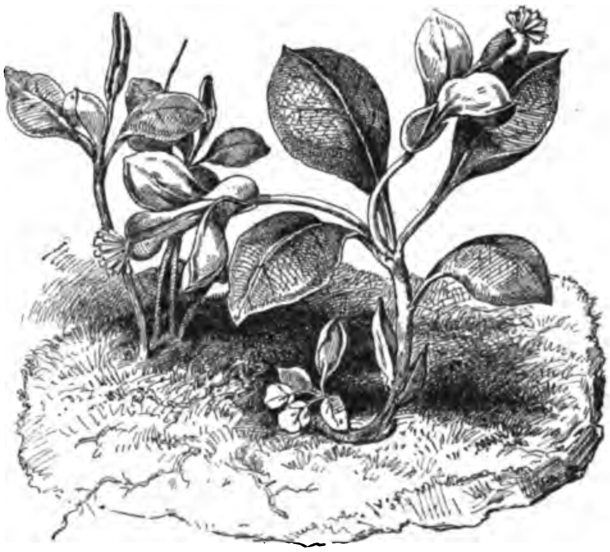
Chamæbúxus, Linn. BOX-LEAVED MILKWORT. Evergreen trailer: upper lvs. lanceolate or elliptical, mucronate; lower lvs. smaller, obovate: peduncles axillary and terminal, about 2-fld.: fls. as many as 10 on a stalk, typically yellow, more or less reddish toward the end of the keel; stamens united only at the base. April–June. Europe, low heaths and woods to highest Alps. L.B.C. 6:593. B.M. 316 (wings white: petals white at base, yellow or red at tip).—Var. **purpùrea** has purple wings, set off by yellow petals. Gn. 13:109; 30:557 (charming: wings rosy pink).

Sénega, Linn. SENECA SNAKEROOT. MOUNTAIN FLAX. Height 1 ft. or less: lvs. 1–2 in. long: fls. white or greenish, 1½ lines long; crest small, few-lobed. May, June. Rocky woods, New Brunswick to Rockies, south N. C. to Mo. B.B. 2:360. L.B.C. 14:1380. B.M. 1051.—Bears no underground flowers.

polýgama, Walt. Height 1 ft. or less: lvs. 1 in. or less long: fls. purple or rose, rarely nearly white, 2–3 lines long; crest relatively large, laciniate. June, July. Dry soil, Nova Scotia to Lake of the Woods, south Fla. to Tex. B.B. 2:360.—Bears numerous underground flowers.

oppositifòlia, Linn. Probably the only species in the genus with opposite lvs.; an abnormal thing in the whole family. Tall, slender shrub: racemes few-fld.: fls. large, purplish. S. Afr.—Harvey gives 8 botanical varieties, of which probably the commonest in cult. is var. **cordàta**, Harv. (*P. cordifòlia*, Thunb., not Presl.). Glabrous or downy: lvs. broadly cordate, acute or acuminate. For pictures of the species and its vars., see B.M. 492; 2438. B.R. 8:636; 14:1146, and L.B.C. 12:1189 (all under various names).

myrtifòlia, Linn. Readily told from *P. virgata*, its inflorescence being a few-fld., leafy raceme, while that of *P. virgata* is many-fld. and leafless. Densely-branched shrub, 3–8 ft. high, with large, showy fls. near the ends of the branches: lvs. flat, variable in shape, but not subulate: lateral petals 2-lobed, the posterior lobe ear-shaped, reflexed. S. Africa.—Var. **grandiflòra,** Hook. (*P. grandiflòra*, Hort. and L.B.C. 13:1227, not Walt.). Fls. over 1 in. long. B.M. 3616. B.R. 8:669. *P. Dalmaisiàna*, which is very like this, is discussed above.



1875. Polygala paucifolia. Natural size.

virgàta, Thunb. Glabrous shrub, 2–5 or even 15 ft. high, with rod-like branches terminating in many-fld., leafless racemes of purple or flesh-colored fls.: anterior sepals distinct: wings obtuse. S. Afr.—The typical form is advertised in S. Calif., but in Eu. probably the only form cult. is var. **speciòsa,** Harv. (*P. speciòsa*, Sims). Glabrous: lower lvs. obovate or cuneate, upper more linear, all obtuse: raceme long and lax: bracts soon deciduous. S. Afr. B.M. 1780. L.B.C. 7:621. B.R. 2:150. B. 1:43.

apopétala, T. S. Brandegee. Frutescent, 2–3 ft. high: branches slender, pubescent: lvs. lanceolate, entire, obtuse, alternate, remote, short-petioled, nearly glabrous: fls. large, pink, on slender pedicels ½ in. or more long; sepals 4, the upper and lower small, equal, cymbiform, margins ciliate, the lateral very large, nearly orbicular; petals 5, separate, upper strap-shaped, two-thirds as long as keel, lateral pointed, less than one-half as long, embraced with the 8 stamens by the large cymbiform keel, which is opened on the upper and lower edge and not cristate, or appendaged: seeds 2, large, ovoid, pubescent. Lower Calif.

amatýmbica, Eckl. & Zeyn. (*P. acuminàta*, E. Mey. & Hort. (?), not Willd.). Densely tufted, erect, 3–6 in. high: lvs. lanceolate acuminate, pungently mucronate: racemes lateral, few-fld., spreading or reflexed: fls. small, wings green, keel and petals flesh color to purple; keel with a many-parted crest. S. Afr.—*P. acuminata* of the trade is probably not *P. acuminata*, Willd., which is *Badiera acuminata*. Badiera differs from Polygala in having 2 of the sepals only a little larger than the others, instead of much larger. W. M.

POLYGONÀTUM (Greek, *many-jointed;* probably referring to the stem). *Liliàceæ.* Solomon's Seal. About 20 species of hardy herbaceous perennials of graceful habit, their unbranched arching stems bearing pendulous, tubular greenish fls., which are succeeded by handsome dark blue berries. The name Solomon's Seal is connected with the horizontal rootstocks which are scarred by the death of the annual stems, each scar being likened to seal (see *Smilacina*). The stems are leafy above, the lvs. ovate or lanceolate, alternate, opposite or whorled: fls. greenish or pinkish, 1–10 in the axils. The genus is distinguished from its nearest allies by the cylindrical perianth-tube with short lobes and small undivided style. The species are natives of the north temperate zone.

Polygonatums are best suited for partially or wholly shaded positions, though they do well in the open in a well-prepared border. They like a deep, rich soil not subject to drought. Easily prop. by division. They are among the best subjects for wild gardening. *P. multiflorum* is used abroad considerably for forcing and for house plants. Our native species are presumably equally desirable for all purposes. The Solomon's Seal of English literature is *P. multiflorum*, which is probably the commonest species native to Europe. There are several Himalayan and Japanese species. The common Solomon's Seal of our nurseries is the European, *P. multiflorum*, the American kinds being listed only by specialists in native plants. The others here described are offered by Dutch bulb-growers. For extended articles on the forcing of *P. multiflorum*, see Gn. 26, p. 236 (or V. 7:337); 30, p. 49, and F.R. 3:594.

A. *Lvs. all whorled.*

verticillàtum, All. Stem 2–3 ft. high: lvs. in whorls of 4–8, linear, 3–6 in. long: fls. in 2's or 3's. Eu., Himalayas. *P. macrophyllum*, Link., is perhaps a distinct var. with more robust habit and larger lvs.

AA. *Lvs. alternate.*

B. *Perianth 2–3 lines thick.*

C. *Height 1–1½ ft.: fls. 1 or 2 in the axils.*

officinàle, All. Lvs. oblong, 2–3 in. long, firmer than those of *P. multiflorum:* perianth-segments greenish. Eu., Siberia. *P. ambiguum*, Link., is offered as a distinct form by Krelage.

CC. *Height 2–4 ft.: fls. 1–5 in the axils.*

latifòlium, Desf. (*P. Thùnbergi*, C. Morr.). Lvs. oblong, 3–6 in. long: perianth-segment greenish. Eu., Asia.—Intermediate in habit between *P. officinale* and *multiflorum* but with earlier fls.

BB. *Perianth 1½–2 lines thick.*

C. *Plant glabrous.*

D. *Filaments densely pilose.*

multiflòrum, All. Fig. 1876. Height 2–3 ft.: lvs. oblong, 3–6 in. long: perianth-tube white; segments greenish. Eu., N. Asia, Himalayas. Gn. 26, p. 236; 30, p. 49. V. 7:337.—Var. **flòre ròseo,** Hort., has rosy fls. There are said to be varieties with double fls. and variegated foliage. The type seems to be more graceful than the varieties. This is the common Solomon's Seal of Europe, where it is also called Lady's Seal and David's Harp.

1876. A colony of Solomon's Seal in a wild garden—Polygonatum multiflorum.

DD. *Filaments somewhat flattened, smooth, not roughened.*

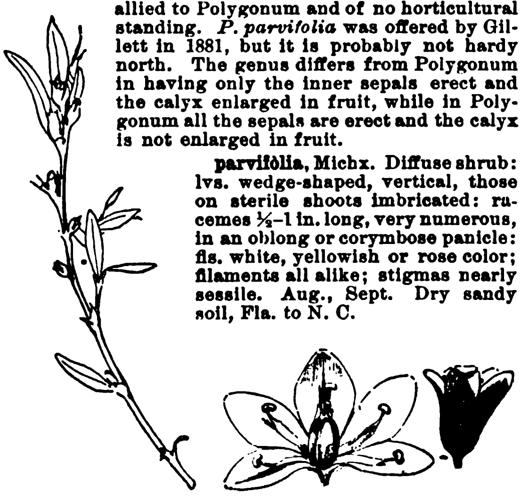
gigantèum, Dietr. Taller and more robust than *P. biflorum*, 1–8 ft. high: lvs. 1½–6 in. long, 3–4 in. wide: fls. 1–8 in the axils. May–July. Moist woods, Rhode Island to Manitoba, south Ga., La., to New Mex. and Utah.

CC. *Plant with lvs. pubescent beneath.*

biflòrum, Ell. Height 8 in.–3 ft.: lvs. 2–4 in. long, ½–2 in. wide: fls. often 2 in axils, sometimes 1–4. April–July. Woods, New Brunswick to Mich., south to Fla. Mn. 8:49. W. M.

POLYGONÉLLA (diminutive of Polygonum). *Polygonàceæ.* About 7 species of American plants closely allied to Polygonum and of no horticultural standing. *P. parvifolia* was offered by Gillett in 1881, but it is probably not hardy north. The genus differs from Polygonum in having only the inner sepals erect and the calyx enlarged in fruit, while in Polygonum all the sepals are erect and the calyx is not enlarged in fruit.

parvifòlia, Michx. Diffuse shrub: lvs. wedge-shaped, vertical, those on sterile shoots imbricated: racemes ½–1 in. long, very numerous, in an oblong or corymbose panicle: fls. white, yellowish or rose color; filaments all alike; stigmas nearly sessile. Aug., Sept. Dry sandy soil, Fla. to N. C.



1877. Common Doorweed or Knotweed, the details enlarged —Polygonum aviculare.

POLÝGONUM (Greek for *many-jointed*). *Polygonàceæ.* Jointweed. Knotweed. Mostly herbs, annual or perennial, with small flowers in racemes, spikes or heads (sometimes solitary). Flowers apetalous; calyx gamosepalous, 4–5-parted; stamens 5–9, sometimes exserted: ovary 1-loculed, with 2–3-parted style or stigma (latter capitate), ripening into a triangular or lenticular akene. Above each joint, the stem is prominently sheathed. Polygonum is closely allied to Rumex, the docks, and also to Fagopyrum, the buckwheats. Rumex differs in uniformly having a 6-parted calyx, some of the lobes often bearing a grain-like tubercle on the back, the stigmas tufted. Fagopyrum differs in having an akene surpassing the calyx and in details of the embryo. Most Polygonums are weedy plants, and only a very small proportion are of merit for cultivation. One of the commonest species is the Doorweed (Fig. 1877), *Polygonum aviculare.* It is a decumbent wiry small-leaved annual or perennial, growing along walks and in other hard, dry soil, where it makes a sod-like mat. The axillary flowers are very small, and seldom seen by others than botanists. Other Polygonums are the common Smartweeds of swales and damp grounds. For monograph of Polygonum, see Meisner, DC. Prodr. 14 (1856). For our native and introduced species, see Small, "Monograph of the North American species of the genus Polygonum," in Mem. Dept. Bot. Columbia College, 1895. The species are perhaps 200, of very wide distribution from arctic to tropical countries.

Most of the cultivated Polygonums are hardy border plants, requiring no special skill or care. They are propagated by seed and division, chiefly the latter. Some of the cultivated kinds are annual, as *P. orientale*, and this species is the only one that is known as a familiar flower-garden plant in this country. Several of the species are amphibious and are quite useful for bog gardens.

INDEX.

affine, 9.
amphibium, 6.
amplexicaule, 10.
arenarium, 5.
Baldschuanicum, 2.
Brunonis, 9.
cilinode, 1.
compactum, 11.
cuspidatum, 11.
elegans, 5.
Hartwrightii, 7.
lanigerum, 8.
multiflorum, 10 and suppl. list.
orientale, 3.
oxyphyllum, 10.
Persicaria, 4.
pumilum, 3.
Sachalinense, 12.
Sieboldi, 11.
speciosum, 10.
variegatum, 3.
Zuccarinii, 11.

A. *Plant twining.*

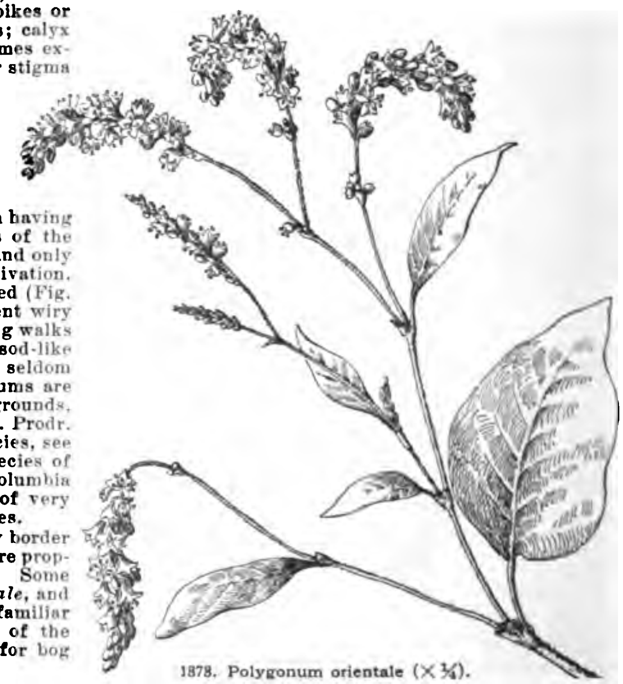
1. **cilinòde**, Michx. Slender somewhat downy climber, mostly perennial: lvs. cordate-ovate to ovate-lanceolate, more or less angular or halberd-shaped at base: stem bearing a ring of retrorse bristles at the base of each sheath (whence the specific name): fls. white, in loose-panicled racemes from the upper axils. Nova Scotia south and west.—Sold as a cover plant for rocks and as a denizen of shrub-masses.

2. **Baldschuánicum**, Regel. Tall perennial climber becoming woody at the base: lvs. cordate-oval or hastate, acuminate, slender-petioled: fls. small but very numerous in terminal erect or drooping panicles, rose-colored: fruiting calyx small, 3-sided, at first whitish and then becoming rose-colored: akene shining black. Bokhara. G.C. III. 16: 656; 21:17. Gn. 55, p. 454. Gng. 5: 181. B.M. 7544.—Offered by one American dealer and listed in the American catalogues of European dealers. Described as a very vigorous and decorative hardy plant, climbing 20 ft. high. It was first described by Regel in 1884.

AA. *Plant erect, or at least not climbing.*

B. *Annual plants of erect habit, to be treated as flower-garden subjects.*

3. **orientàle**, Linn. Prince's Feather. Kiss-me-over-the-garden-gate. Fig. 1878. Tall-growing, much branched above, hairy: lvs. large, ovate or cordate-ovate or broad-oblong, acuminate: sheaths short, ciliate and sometimes bordered at the summit: fls. bright pink, in close, cylindrical spikes that are arranged in open panicles, the stamens 7 and the akene lenticular. India. B.M. 213.—An attractive old-fashioned plant growing as high as the fence. It is most easy of cultivation. In fact, it usually self-sows in old gardens. In some places it has run wild. There are horticultural



1878. Polygonum orientale (× ¼).

varieties, as var. **variegàtum**, Hort., with foliage marked with yellowish white, and var. **pùmilum**, Hort., with compact habit and the stature half that of the type.

4. **Persicària**, Linn. LADY'S THUMB. Fig. 1879. One of the Smartweeds, but sold by seedsmen as a suitable plant for backgrounds; glabrous or nearly so, erect or somewhat diffuse, 1–2 ft. tall: lvs. lanceolate to linear-lanceolate, slightly ciliate, usually with a triangular or crescent-shaped spot near the middle of the blade (whence the name Lady's Thumb): sheaths short, hairy on the margin: fls. in short spikes, pink or greenish purple, the stamens 6 and the akene lenticular or triquetrous. Eu.—Naturalized everywhere about dwellings.

1879.
Lady's Thumb — Polygonum Persicaria.
Much reduced.

5. **arenàrium**, Waldst. & Kit. (*P. élegans*, Ten.). Dwarf species with slender wiry branches and long internodes: lvs. small, linear-lanceolate, 1-nerved, bearing great numbers of little whitish fls. along the stem, the terminal clusters leafless. S. Eu.—Offered in Calif., for rockeries and bouquets.

BB. *Perennial plants of various habit, usually with strong rootstocks.*

C. *Native smartweed-like plants, sometimes offered for naturalizing in bog gardens.*

6. **amphibium**, Linn. Much spreading and creeping, rooting at the joints, at first more or less pubescent but becoming glabrous with age: lvs. rather thickish and large, oblong, elliptic or lance-elliptic, mostly obtuse or very nearly so: sheaths short, usually not fringed or bordered at the summit: fls. light rose-colored, in a short, dense, terminal spike, the stamens 5 and exserted, and the akene lenticular. In water or bogs, across the continent.—When growing in water, the floating leaves become long-petioled.

7. **Hártwrightii**, Gray. Differs from the last in having many narrow-lanceolate lvs., bordered and fringed sheaths, and hispid stems. Muddy places, across the continent.

CC. *Exotic plants, used mostly for borders, and appearing regularly in the trade.*

D. *Whole plant white-woolly.*

8. **lanigerum**, R. Br. Stems thick, creeping at the base, but the tops erect and standing 2–5 ft. high, much branched: lvs. narrow-lanceolate and more or less recurved, acuminate, covered with down of the color of old silver: sheaths short, not ciliate: fls. small, red or copper-colored (varying to white), in racemes on slender forking peduncles, the stamens 6, and the akene flat and shining black. Tropics of Old World and, according to Hooker, of America. R.H. 1891, p. 567.—Lately introduced for subtropical gardening, and not yet tested in the North. It probably will not endure northern winters even with good protection, but it is readily propagated each year from cuttings taken from plants carried over winter for that purpose.

DD. *Whole plant green or grayish, not white-woolly.*

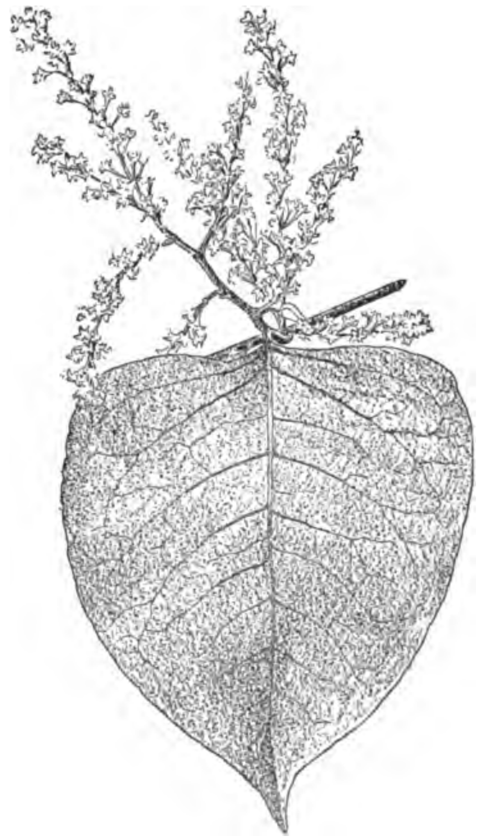
E. *Fls. pink or red (sometimes varying to white), in erect spikes: plants grown for their flowers.*

9. **affine**, Don (*P. Brunònis*, Wall.). Tufted glabrous plant, with flowering stems 1 ft. or less high, from a woody prostrate rootstock: lvs. mostly radical, oblanceolate to spatulate to lance-oblong: sheaths rather long, split or entire: fls. bright rose-red, in dense, erect, terminal spikes 2–3 in. long, the stamens 8, the akene trigonous. Himalaya, at elevations of 9,000 to 14,000 ft. B.M. 6472.—An excellent little plant for cool places, blooming in autumn.

10. **amplexicaùle**, Don (*P. oxyphýllum*, Wall. *P. speciòsum*, Meisn. *P. multiflòrum*, Hort.). MOUNTAIN FLEECE. Strong-growing tufted green-stemmed plant 2–3 ft. tall, from a woody rootstock: lvs. cordate-ovate to cordate-lanceolate, short-petioled or clasping, the margin wavy and crenulate, long-acuminate: sheaths long and split or lacerate: fls. rose-red or white, rather large, in strict, long-peduncled spikes 2–6 in. long, the stamens 8 and exserted, the akene trigonous. Himalaya, from 6,000 to 13,000 ft. altitude. B.R. 25:46. B.M. 6500.—An excellent border perennial, blooming in midsummer. Some, at least, of the plants that have been cult. as Mountain Fleece are a native Polygonum (*P. emersum*), which grows nearly throughout North America, including Mexico.

EE. *Fls. white or greenish, in axillary clustered racemes: plants not grown for their flowers. (More or less diœcious or polygamous.)*

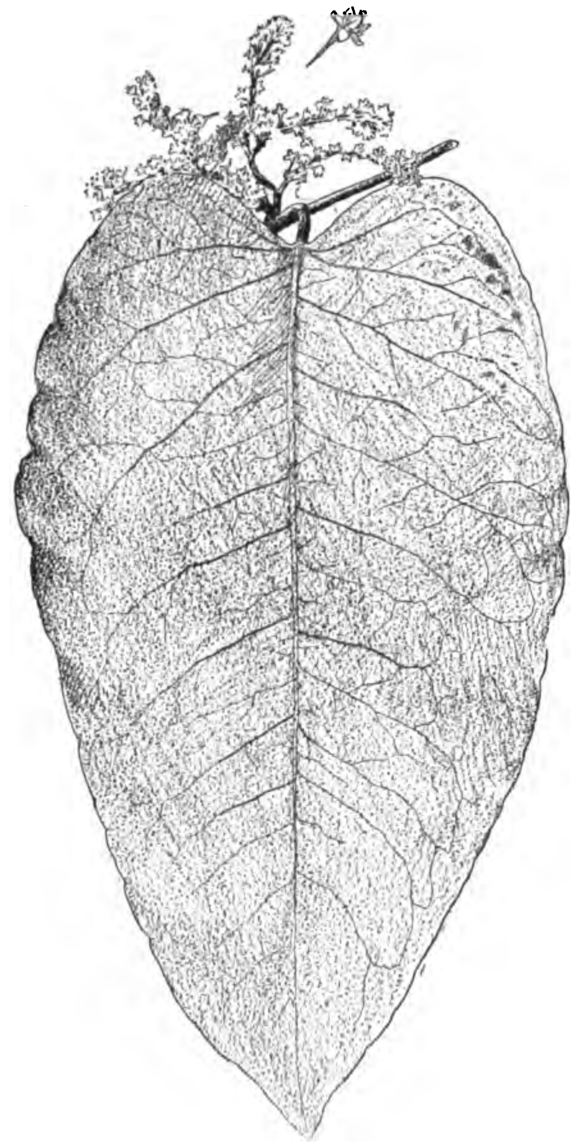
11. **Sièboldi**, De Vriese (*P. cuspidàtum*, Sieb. & Zucc., not Willd. *P. Zuccarinii*, Small). Fig. 1880. Strong, stout, handsome bushy perennial (stalks dying to the ground in winter), growing 3–5 ft. high, the stems gracefully curving outward: lvs. short-oval to orbicular-ovate, truncate or slightly cordate at base, abruptly pointed, the strong side nerves uniting in marginal loops: sheaths short and flaring, deciduous: fls. small and whitish, very numerous in slender-panicled racemes, the stamens 8, and the akene trigonous. Japan. B.M. 6503. R.H. 1858, p. 631; 1894, p. 54. Gn. 26, p. 317; 49, p. 238.—A very effective plant for bold mass effects, perfectly hardy in the northern states, and now frequently planted. It is everywhere known in the trade as *P. cuspidatum*. It produces clouds of bloom. Var. **compáctum** is cult.



1880. Polygonum Sieboldi (P. cuspidatum) (X ⅓).

12. **Sachalinénse**, Schmidt. SACALINE. Fig. 1881. Exceedingly vigorous plants, spreading rapidly from the tips of strong underground shoots, the reddish glabrous dead stalks often standing 8–12 ft. high through the winter: lvs. very large, frequently 1 ft. or more

long, soft dull green, the blade oval-oblong, 1⅓-2 times as long as broad, shallow-cordate at base, scarcely pointed, the prominent side veins uniting by the ends: fls. greenish, in relatively small axillary clusters, the akene trigonous. Island of Sachalin, north of Japan, in Russian territory. B.M. 6540. R.H. 1876, p. 36; 1893, pp. 394, 395; 1894, p. 55. Gn. 21, p. 280. G.C. II. 26:813 and III. 14:159 (in fr.). G.M. 31:176. V. 17:161.—Recently introduced (in N. Amer. in 1894) for forage and for ornament. It is inveterately persistent when once established, and may easily become a pest. For forage it has little merit where other things can be grown, for it is too coarse. For planting in rough places, where a thick cover is required, it is one of the best of all herbaceous perennials. It is perfectly hardy in the North and seems to thrive anywhere. *P. Sieboldi* was once distributed as Sacaline, but that species is much smaller, with smaller, shorter and square-based leaves, and with more profuse bloom.



1881. Sacaline—Polygonum Sachalinense (× ⅓).

P. compáctum, Hook., is much like P. Sieboldi, but "differs in its dwarf size, decumbent lowly habit, small rigid leaves, with waved margins, and strict erect simple female racemes." Japan. B.M. 6476.—*P. multiflòrum*, Thunb. Tuberous-rooted climber, with reddish stems: lvs. cordate-ovate-acute, shining: fls. small and whitish in spreading panicles. China and Japan.—*P. platycaùlon*, Hort. = Muehlenbeckia Platyclados.—*P. sphærostàchyum*, Meisn. Allied to P. affine, from which it differs in the "dense broad cylindric or globose spike of blood-red pendulous flowers." Himalaya. B.M. 6847.—*P. vaccinifòlium*, Wall. Rock plant allied to P. affine: fls. bright rose-colored, in many slender spikes: lvs. rather numerous on the stems, short, ovate-acute: decumbent, the stems 2 ft. or less long. Himalaya, up to 16,500 ft. B.M. 4622. Gn. 39, p. 543; 43, p. 501; 45, p. 159.

L. H. B.

POLÝMNIA (the muse Polyhymnia). *Compósitæ.* About 10 species of American composites, mostly coarse, viscid and heavy-scented, the North American species being perennial herbs, the South American shrubby or tree-like. They have loose panicles of yellow or whitish fls. borne in summer. For further description, see Gray's Manual, Britton and Brown's Illustrated Flora, etc.

Canadénsis, Linn. CANADA or SMALL-FLOWERED LEAF CUP. Height 2-5 ft.: lvs. deltoid-ovate to hastate, thin, deeply angulate-lobed; lobes dentate, 4-10 in. long: heads few in terminal clusters, 4-6 lines broad: rays minute or none. June-Sept. Damp, rich, shaded places, western Ont. to Minn., south N. C. to Ark. B.B. 2:405.—Var. **radiàta**, Gray, with whitish rays sometimes ½ in. long, is also offered by one dealer in native plants.

POLYPÒDIUM (Greek, *many feet;* alluding to the extensive rootstocks). *Polypodiàceæ.* A genus of ferns with naked rounded sori, and with the lvs. jointed to the rootstocks, leaving a scar when they separate. As here treated the veins may be free or united to form areolæ. The genus is a very extensive one, growing in all parts of the world, and has frequently been divided into a series of genera based on habit and the nature of venation, which is probably a more logical treatment; some of these genera, indeed, as Phymatodes and Phlebodium, have been here separated; the genus would be more homogeneous were others placed by themselves. For culture, see *Fern.*

A. *Veins free: lvs. once pinnate.*

B. *Sori large, conspicuous.*

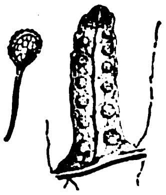
vulgàre, Linn. WALL FERN. POLYPODY. Figs. 1881-3. Lvs. 4-10 in. long, on pale stalks half their length, 1-3 in. wide, cut nearly or quite to the rachis into entire or slightly toothed blunt pinnæ. New England to Ala. and westward to Ore.; also common throughout Europe, where many forms are in cult. Var. **Cámbricum** (Fig. 1884) occurs in New York and New England.

falcàtum, Kellogg. Lvs. 12-15 in. long, 4-8 in. wide, on long, straw-colored stalks; pinnæ numerous, tapering to a slender point, sharply serrate. Calif. to Wash.

BB. *Sori smaller: lvs. elastic, often elongated.*

Plùmula, HBK. Lvs. 9-18 in. long, narrow lanceolate, 1-2 in. wide; pinnæ numerous, narrow, entire, blunt, the lower pairs scarcely smaller than those above; stalks blackish. Fla. and trop. Amer.

pectinàtum, Linn. Lvs. elliptic-lanceolate, 1-2½ ft. long, 2-6 in. wide, cut to the rachis into horizontal entire or toothed pinnæ, the lower ones gradually reduced to short, triangular lobes. Fla. and trop. Amer.



1882. Sori and a single sporangium of Polypodium vulgare. Sori about natural size.

AA. *Veins uniting, forming regular areolæ each with a single free included veinlet.*

C. *Lvs. simple, undivided.*

vacciniifòlium, Langs & Fisch. Lvs. of 2 sorts rising from slender, wide-creeping rootstocks; sterile lvs. roundish or elliptic; sporophylls linear or ligulate, with large sori in a single row. Tropical Amer., from the West Indies southward.

CC. *Lvs. pinnate.*

D. *Fronds covered with flat scales underneath.*

polypodioides, A. S. Hitchcock. Lvs. 2–6 in. long, an inch or more wide, with entire pinnæ; veins indistinct, from the thick texture. Va. and southern Ill. to Brazil; commonly growing on trees in the southern states.

1883. Polypodium vulgare (× ¼).

DD. *Fronds smooth beneath.*

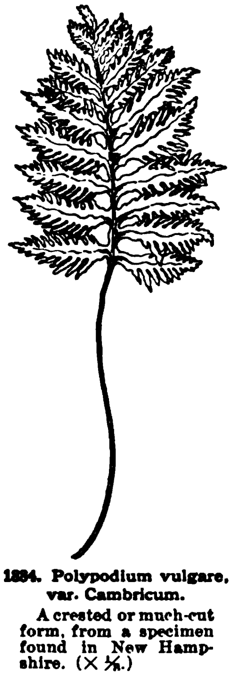
E. *Pinnæ broad at base and often confluent.*

Califórnicum, Kaulf. Lvs. 4–9 in. long, 1–5 in. wide, cut into finely toothed pinnæ which are mostly confluent at the base. California.—Has much the habit of the European forms of *P. vulgare*.

Catharinæ, Langs. & Fisch. Lvs. 6–12 in. long, 3–5 in. wide, with numerous nearly opposite pinnæ which are dilated at the base, contracted just above the base, and slightly enlarged and bluntly rounded at the tip; sori large near the midrib. Brazil.

EE. *Pinnæ narrowed and distinct at base*

fraxinifòlium, Jacq. Lvs. 2–4 ft. long, 12–18 in. wide, on firm stalks 1–2 ft. long; pinnæ 4–9 in. long, with a tough, somewhat leathery texture and entire margin. Columbia to Brazil and Peru.



1884. Polypodium vulgare, var. Cambricum.

A crested or much-cut form, from a specimen found in New Hampshire. (× ⅓.)

subauriculàtum, Blume. Stalks 6–12 in. long, glossy, from wide-creeping rootstocks: lvs. 2–3 ft. long, 8–12 in. wide; sori in a single row immersed in the leaf. India to Australia.

AAA. *Veins (primary) distinct from midrib to the edge, connected by parallel transverse veinlets forming rows of similar areolæ.*

B. *Lvs. elongate, simple, smooth beneath.*

Phyllitidis, Linn. Lvs. 1–3 ft. long, 1–4 in. wide, with an acute point, and the lower part narrowed gradually; areolæ in rows of 6–12, usually with 2 sori each. Fla. to Brazil.—This species might more justly be placed in the genus Campyloneuron.

BB. *Lvs. with under surface tomentose.*

Lingua, Swz. Lvs. 4–8 in. long, 1–4 in. wide, the apex often cuspidate, the base narrowed or rounded; upper surface naked, the lower matted with reddish cottony brown; sori in close rows of 4–6 each. Japan to Ceylon.—This species and the next are often placed in the genus Niphobolus.

tricúspe, Swz. Lvs. hastate, 2–4 in. each way, with a central lanceolate-triangular lobe and spreading lateral ones which are more or less auricled at the base. Japan and Corea.

P. aùreum. See Phlebodium.—*P. Dryópteris.* See Phegopteris Dryopteris.—*P. glaùcum.* See Phymatodes.—*P. hexagonópterum.* See Phegopteris.—*P. Kerandreànum.* See Phegopteris.—*P. musæfòlium.* See Phymatodes.—*P. nigréscens.* See Phymatodes.—*P. Phegópteris.* See Phegopteris Polypodioides.—*P. Phymàtodes.* See Phymatodes.—*P. plumòsum* is a form of Asplenium filixfœmina.—*P. quercifòlium.* See Drynaria.—*P. rigídulum.* See Drynaria.—*P. Swártzii.* See Phymatodes.

L. M. UNDERWOOD.

POLYPODY. See *Polypodium*.

POLÝPTERIS (Greek words meaning *many-winged* or *feathered*; referring to the pappus). *Compósitæ.* This includes a handsome, rosy-fld. hardy annual known to the trade as *Palafoxia Hookeriana*. Polypteris is a genus of 4 species of North American herbs: lvs. mostly entire, alternate or the lower opposite, and lax corymbosely panicled heads of fls. borne in summer and autumn: involucre broadly bell-shaped or top-shaped; bracts commonly in 2 series, more or less colored and petal-like toward the tips: rays wanting except in *P. Hookeriana*: akenes linear to club-shaped, 4-sided: pappus of 6–12 equal scales. Distinguished from Palafoxia by the colored tips of the involucral bracts and the deeply divided limb of the corolla. Monographed in Gray's Synoptical Flora.

Hoòkeriana, Gray (*Palafóxia Hookeriàna*, Torr.). Annual 1–4 ft. high: lvs. lanceolate, mostly 3-nerved below: heads 1 in. or more across; rays 8–10, deeply 3-cleft. Sandy plains, Neb. to Tex. B.M. 5549.—Handsome plant; sometimes treated as an everlasting.

POLÝSCIAS (*many* and *shade;* referring to the abundant foliage). *Araliàceæ.* Large shrubs or trees, glabrous, of about 8 species of India, Africa and Malaya. Lvs. pinnate, with thick entire leaflets: fls. small, usually 5-merous (sometimes 4-merous), the calyx truncate or toothed, the petals valvate, the ovary 5–8-loculed, the styles usually of the same number and distinct. Polyscias is allied to tropical Aralias and Panax, and the culture is the same as for those plants. For further botanical discussion, see *Panax*.

paniculàta, Baker (*Terminàlia élegans*, Hort.). Erect, glabrous shrub: lvs. pinnate, usually with 7 lfts., of which the terminal one is 7–9 in. long, oblong and obtuse, shining. Mauritius.—This is another example of the confusion which arises from the naming of garden plants before their flowers or fruits are known. For several years this plant was supposed to be a Terminalia, but now it is known to belong to a wholly different family. Another example is *Aralia Chabrieri* of the gardens, which belongs to the Celastraceæ (Elæodendron).

pinnàta, Forst. (*Aràlia latifòlia*, Wight & Arn.). Leaflets orbicular, either nearly entire or with small and remote teeth, the base heart-shaped. Malaya.—The writer does not know that the *Aralia latifolia* of gardeners is the above plant, as he has not seen it. *Aralia latifolia* of the trade is described as "very bold and rich in appearance; green and pale yellow leaves."

L. H. B.

POLYSTÀCHYA (Greek, referring to the many spikelets). *Orchidàceæ.* About 40 species of tropical epiphytic orchids, none of which have showy fls. *P. luteola*, a native of the West Indies, has minute greenish yellow fls. and has probably been cult. in America, but is not worth while. Sepals connivent or subpatent, the lateral ones connate with the short foot of the column into a mentum: column short: flowering stems short, few-leaved, pseudobulbous. See *Orchid*.

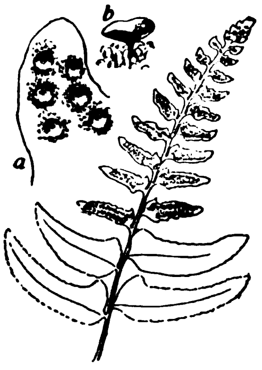
lutèola, Hook. (*Dendròbium polystàchyon*, Sw.). Height 6–12 in.: lvs. oblong-linear or lanceolate-oblong, exceeded by the stem; lip 3-lobed to the middle.

POLÝSTICHUM (Greek, *many rows*; referring to the sori). *Polypodiàceæ.* A genus of ferns mostly of temperate regions with free veins and the roundish sori covered by indusia that are peltate and attached to the leaf by a short central stalk. They are mostly easily grown and thrive best in shade. Some of the species do well in living-rooms. All the species have also been described under the genus Aspidium. For culture, see *Ferns.*

A. *Lvs. simply pinnate throughout.*

B. *Lower pinnæ gradually reduced to mere lobes.*

Lonchitis, Roth. (*Aspidium Lonchitis*). HOLLY FERN. Lvs. 9–20 in. long, rigid, the pinnæ broadly lanceolate-falcate, the lowest triangular. North Europe and America, mostly in high latitudes.



1885. Details of sporophylls of Polystichum acrostichoides. *a*, sori; *b*, indusium.

BB. *Lower pinnæ scarcely if any smaller than those above.*

acrostichoides, Schott (*Aspidium acrostichoides*, Swz.). CHRISTMAS FERN. Figs. 1885, 1886. Growing in dense crowns, with stalks 6–8 in. high, the pinnæ linear-lanceolate, somewhat falcate, and serrulate with appressed teeth; spire-bearing pinnæ contracted, with confluent sori. Eastern United States. — One of our commonest species.

munitum, Kaulf. (*Aspidium munitum*, Kaulf.). Stalks 4–12 in. long, chaffy at base or throughout; pinnæ long, linear-acuminate, serrate or doubly serrate; sori in a single row midway from midrib to margin. Utah northward and westward.

lepidocaùlon, Hook. Stipes densely clothed with large, heart-shaped scales: lvs. short, with 12–15 pairs of pinnæ, unequal-sided, scarcely toothed: sori usually in two rows. Japan.

AA. *Lvs. with auricles of pinnæ forming distinct leaflets.*

viviparum, Fée. Lvs. 12–18 in. long, 4–6 in wide, with numerous lanceolate pinnæ; lower basal margin obliquely truncate; sori in 2 or 4 rows. West Indies.

AAA. *Lvs. bipinnate in the lower two-thirds.*

C. *Pinnules auricled.*

aculeàtum, Roth. (*Aspidium aculeàtum*, Swz.). Lvs. 2 ft. or more long, 6–8 in. wide; pinnules twice as long as wide, with very conspicuous basal auricles. Eu. and Calif.—*P. proliferum*, Hort., is an Australian form producing buds on the leaves.

angulàre, Willd. Lvs. 1–2 ft. long, rather narrowly lanceolate; pinnules nearly triangular, two-thirds as broad as long, more or less incised. Europe.

Braùnii, Lawson. Lvs. 18–24 in. long, narrowly elliptic-lanceolate; pinnules 7–10 pairs to each pinna, broad, the upper basal edge parallel with the rachis. Eu., and mountain regions of eastern America.

CC. *Pinnules scarcely auricled.*

Richárdi, Hook. Lvs. 9–18 in. long, ovate-deltoid, with 12–15 pairs of pinnæ; pinnules deeply toothed, texture coriaceous. New Zealand.

amábile, Blume. Lvs. 1 ft. or more long, 6–9 in. wide, with a lanceolate terminal pinna and 3–6 pairs of lateral ones; pinnules subrhomboidal, the upper and outer portions sharply spinulose serrate. India, Japan and East Indies.

AAAA. *Lvs. more than once pinnate in the lower pinnæ.*

Capénse, J. Sm. (*P. coriàceum*, Swz.). Stalks 1–2 ft. long: lvs. 1–3 ft. long, subdeltoid, the segments lanceolate and bluntly lobed, the teeth not mucronate. S. Africa, S. America and New Zealand.

aristàtum, Swz. Stalks scattered, 12–18 in. long, scaly below: lvs. 1–2 ft. long, 9-12 in. wide, 3–4-pinnatifid, the lower pinnæ largest; texture firm, glossy: sori in 2 rows near the midrib. Japan to Ceylon and Australia.

L. M. UNDERWOOD.

POMADÉRRIS (Greek words said to refer to the membranous covering of the fruit). *Rhamnàceæ.* Here belongs the Victorian Hazel, *P. apetala.* According to Bentham this is a shrub 3–6 ft. high, but Von Mueller, in his "Select Extra-Tropical Plants," says it is "a tree attaining a height occasionally of 60 feet, but mostly smaller. The foliage is devoured with avidity by pasture animals, often in preference to ordinary good feed. The genus contains several other large-leaved species." The genus is confined to Australia and New Zealand, and 18 species are described in the Flora Australiensis. They are mostly shrubs with foliage matted with white felt beneath and very small and numerous fls. in umbel-like cymes forming terminal panicles or corymbs. Calyx-tube entirely aduate to the ovary, the limb 5-parted, deciduous or reflexed; petals either concave or flattish or none; stamens 5, the filaments long and usually suddenly inflected and alternate near the top; disk annular, never very prominent; style 3-cleft, rarely almost entire: capsule septicidally 3-valved.

apétala, Labill. Lvs. 2–4 in. long, irregularly crenate and rugose: calyx stellate-tomentose or hoary, with a very short tube: cymes rather loose, numerous in much-branched panicles: petals none. Australia. Cultivated in California for ornament. See *Rulingia.*

W. M.

POMEGRANATE, the vernacular of *Punica Granatum*, a small tree of southern Asia, grown both for ornament and for its edible fruit. Fig. 1887. See *Punica.* It is somewhat grown in the open in the southern states, and also as a pot- or tub-plant in greenhouses in the North.

The natural habit of the Pomegranate is of rather bushy growth, but by careful training a tree 15–20 ft. may be produced. This, however, seems possible only in the extreme southern sections of the United States. A great many shoots spring from the base of the plant; these should be cut out, as it is contended that they withdraw the nutriment which should go to the fruit-bearing stems. The branches are slender, twiggy, nearly cylindrical, somewhat thorny; lvs. lanceolate, long, narrow, glossy green and with red veins; fls. with a red-colored, thick, fleshy calyx, crowned with bright scarlet, crumpled petals and numerous stamens. The fruit is globular, topped with a crown-like calyx, and the interior consists of numerous seeds enveloped in a bright, crimson-colored pulp, seeds being arranged in segments, separated by a thin skin, and very acid in the typical variety. A cooling, acescent drink is made

1886. Christmas fern—Polystichum acrostichoides.

from the pulpy seeds, with the addition of water and sugar. This is much used at the South, and is especially grateful in fevers. The plant is injured by a cold of from 8 to 15° above zero, hence it is not hardy above the 34th degree of latitude north. For higher latitudes it should be cultivated in tubs, and given a conservatory during winter. For some sections of the South it is used for hedges. The fruit begins to ripen about September and can be kept for several weeks.

The Pomegranate is multiplied by hardwood cuttings planted in open ground during February, or by layers and also by softwood cuttings during summer. As the plant forms many shoots, these are often used, as they usually are provided with rootlets.

1887. Pomegranate (× ½)

The Pomegranate is supposed to have been introduced into southern Europe by the Carthaginians, whose Latin name of "Punicus" was thus given and derived. We also find a reference in the sacred scriptures. Theophrastus described it 300 years before the Christian era, and Pliny considered it one of the most valuable fruits, both as to its beauty and medicinal properties. The bark of the root is a well-known astringent employed in therapeutics, in dysentery and diarrhœa; the rind of the fruit when boiled has for many generations past been the remedy for tenia, and a jet-black, smooth writing ink is also made of it.

The Pomegranate is a native of some parts of Asia, and by some botanical authors is said to be also found in northern Africa and China. Although of such ancient origin and cultivation, there are but few varieties of the fruit-bearing section disseminated in this country and Europe, but, according to Firminger, several fine varieties have been grown in Bengal from seed brought from Cabul, one being seedless, another growing to the size of "an ordinary human head," and still another as large as a small shaddock.

Varieties Grown for Fruit.

Acid or *Wild*.—With a sharp acid pulp: fruit often very large, from 3-4 in. in diam. and with a bright-colored rind.

Sweet.—Fruit usually somewhat smaller than the Acid and with a darker-colored rind; pulp sweet.

Subacid.—Differs only from the Sweet in the more acidulated pulp.

Spanish Ruby.—As cultivated in Louisiana seems to be only a form of the Subacid. Fruit large and bright-colored with deep crimson pulp. It is considered the best of its class.

Dwarf.—A form of the Acid variety, of very low and bushy growth: fls. single: fr. from 1½-2 in. in diam.; pulp very acid. This can be grown in a pot, as it fruits quite abundantly.

All these varieties are very ornamental from their abundant yield of bright scarlet flowers, which are produced upon the extremities of the young branches of the same year's growth. When the plant is grown in a tree form, the branches should be annually cut back after the leaves drop.

Varieties Grown for Ornament (non-fruiting).

Double Red.—With a very large calyx, from which protrude numerous large bright scarlet petals, larger than those of the common single type. These are produced in abundance during summer and fall and resemble a bright scarlet pompon.

Double Yellow.—Similar to the above in shape of flowers, but latter are of a pale yellow color.

Double Variegated, or *Legrellei*.—A very handsome variety with very large fls., the petals being striped and mottled with yellow and scarlet.

Double Dwarf, or *Punica nana racemosa*.—Of dwarf growth, with bright scarlet, double flowers which are borne in clusters. This is especially desirable for growing in pots, as its flowers are abundant and lasting.

P. J. Berckmans.

POMELO. Also known as *Pumelo*, *Pumelow*, *Pompelos*, *Grape-fruit*, *Forbidden Fruit*, *Fruit of Paradise;* by the French as *Pompelmouse*, and by the Spanish and Dutch as *Pompelmoes*. Pomelo is a contraction of *pomum melo*, the melon apple. Fig. 1888. This desirable fruit is botanically *Citrus Decumana* (see p. 324, Vol. I). Macfadyen, in his Flora of Jamaica, made it a separate species under the name of *Citrus Paradisi* (see G. F. 9:163), but this name has not been retained. *C. Decumana* includes both the Pomelos and the Shaddocks.

Citrus Decumana is a native of the Malayan and Polynesian Islands, but is now extensively cultivated in India, the West Indies, Florida, California, and in most tropical and semi-tropical countries. It is a handsome tree, about 25 to 30 ft. high, with suberect branches. Lvs. large, oval or ovate-oblong, crenulated, and usually emarginate, with scattered pubescence along the margins; petiole slightly broadly winged: fls. large, white; stamens 16-24: fr. usually pale lemon-color, either globose or pyriform, the best varieties being about twice the size of a good orange; pulp pale yellow or greenish white. The pear-shaped form is not now cultivated, and the very large, thick-skinned varieties with coarse flesh are undesirable. One of the best varieties of Pomelo or Grape-fruit known is grown in the hills of Jamaica, and of late years has been very extensively planted throughout the island. It is a fruit about 16 inches in circumference, pale lemon-color, with smooth skin and oil glands very noticeable but below the surface. The pulp is pale yellow or greenish white, subacid in flavor, or fairly sweet when the fruit is quite ripe. The fruits are borne usually in clusters of from 3 to 15, hence the name *Grape-fruit* (in clusters or bunches like grapes), by which it is known in Jamaica. This fruit commands a ready sale at highly remunerative prices in the New York and other markets. Many varieties of Pomelo are now cultivated, the majority of these having originated in California or Florida.

1888. Pomelo or grape-fruit (× ⅛).

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The Pomelo is much esteemed as a dessert fruit, and has the reputation of being an excellent digestive. It contains sugar and citric acid, with much essential oil in the peel. In Jamaica this fruit tree is propagated from seeds, or by budding on the rough lemon stock. It grows in company with the orange, and requires the same treatment; it is not, however, so liable to disease as the orange, nor is it so much affected by scale and other troublesome insects.

Shaddock.—Although botanically the Pomelo and Shaddock are of one species, as known horticulturally in Jamaica they are very different. The Shaddock is a smaller tree than the Pomelo, with larger leaves, but the greatest difference is in the fruit. Whilst one is an esteemed and valuable dessert fruit, the other is hardly ever used, and is not exported. There are two varieties of Shaddock,—one with a globose fruit and flesh of a pale color, the other pear-shaped, with crimson flesh. In both, the fruits are very large, often weighing 15 or 16 pounds; the rind is exceedingly thick, the vesicles are large and distinct, but the flesh is dry and coarse, except in occasional varieties. The Shaddock is said to have been brought to the West Indies by Captain Shaddock.

Hog Shaddock.—This variety is very like the pear-shaped Shaddock in appearance, and it is probably a hybrid between the Shaddock and the citron, or the rough lemon. It is of no value whatever as a fruit, being intensely bitter, but it is used for the purpose of cleaning floors to kill fleas, which are troublesome in some houses at certain seasons of the year. The Hog Shaddock is said to make an excellent stock on which to bud Pomelo. W. HARRIS.

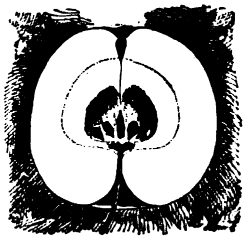
THE POMELO IN FLORIDA.—In no place in the world has the culture of the Pomelo reached such perfection as in Florida. Indeed, the improvement of the fruit and extension of its cultivation in that state has led to its establishment as an important commercial fruit. Its cultivation as a market fruit has been extended from Florida to California and Jamaica, and it is only in these localities as yet, so far as the writer is informed, where any of its varieties are grown on a commercial scale. In most foreign countries the pear-shaped Pomelos, or Shaddocks as they are more properly called, are considered superior to the round varieties, but in this country the industry has been built up with the round types, varieties of which have been developed that are much sweeter and of better quality and flavor than any of the pear-shaped forms or Shaddocks. The good varieties grown for the market in Florida are almost entirely of native origin, though one fairly good sort—the Pernambuco—was introduced from South America.

In Florida the Pomelo is, in general, cultivated and manured the same as the orange. The trees grow rather larger than the orange, however, and should be given considerable space. They are ordinarily planted about 30 feet apart. Pomelo seedlings from fruits of good quality usually produce good marketable fruits, but the differentiation of varieties has progressed far enough so that advanced horticulturists recommend budding or grafting in order to secure fruit of the best quality. (For a short description of the varieties commonly grown see *Citrus Decumana.*) The Pomelo is usually budded either on its own stock or on that of the sweet orange or sour orange. Many growers think that it gives best results when budded on its own stock, and this is very extensively practiced in Florida. The Pomelo is more easily injured by cold than the orange, and in the freeze of 1894–5 in Florida all trees in the northern and central part of the state were killed to the ground. Since this time large plantings have been made in southern Florida, and in a few years a much larger crop will be produced than ever before. Considerable quantities of the fruit are also being produced in California.

H. J. WEBBER.

POMME BLANCHE. *Psoralea esculenta.*

POMOLOGY (Literally, *science of fruits*). All those subjects, both practical and scientific, that have to do with the growing of fruits are assembled under the term Pomology. It is synonymous with Fruit-growing. There has been an effort to divorce the terms Pomology and Fruit-growing, making the former comprise the scientific and classificatory subjects and the latter the practical subjects; but such division is arbitrary and is opposed to usage. The word "growing" can no longer be held, when used in such connection, to designate merely the planting and care of fruit-plants, for all good practice is indissolubly associated with scientific knowledge and theory. Fruit-growing is a more familiar and homely term than the Latin-Greek word Pomology, and for that reason it has seemed to some persons to be less adaptable to the formal presentation of the knowledge connected with fruits. It is significant, however, that with the exception of Prince's "Pomological Manual," none of the fruit books that have done much to mold public opinion in America have been known as Pomologies, notwithstanding the fact that the greater number of them have given great attention to formal descriptions of varieties. The term Pomology is founded on the Latin *pomum*, a word that was used generically for "fruit." In later Latin it came to be associated more particularly with the apple-like fruits. The word is preserved to us in the French *pomme*, meaning "apple," and in other languages of Latin derivation. In English we know it as *pome*, a botanical term used to designate fruits that have the peculiar morphological structure of the apple and pear. This use of the term is explained under the article *Pyrus*. A pome is shown in Fig. 1889. The "core," inside the light dotted line, is the ripened carpels; the flesh, outside this line, is the thickened torus or receptacle, on the top of which the calyx or "eye" is borne. However, the root of the word Pomology is derived from the Latin *pomum* rather than from the botanical *pome*.


1889. A pome, as the term is now understood.

The limitations of pomology, as an art and science, depend on the use of the word "fruit." This word, as used by the horticulturist, is impossible of definition. Products that are classed with fruits in one country may be classed with vegetables in another. To the horticulturist a fruit is a product that is closely associated, in its origin, with the flower. As used in this country, a fruit is the product of a bush or tree or woody vine, the most marked exception being the strawberry. Most fruits may be grouped under three general heads,—orchard or tree fruits, vine fruits (of which the grape is the type), and small fruits. Of the orchard fruits, the leading groups are the pome fruits (apples, pears, etc.), drupe fruits (peaches, plums, cherries, etc.), and the citrous fruits (oranges, lemons, etc.). The species of fruits that are fairly well known in North America are not less than 150, but the important commercial species are not more than 40.

1890. Apple orchard at bearing age, as seen in the northeastern states.

Fruit-growing is the most important and characteristic horticultural interest of North America. In fact, North American pomology may justly be said to be the best and most progressive in the world if excellence is measured by commercial standards, quantity of product, and the quickness and precision with which scientific theory and discovery are applied to it. Most remarkable examples of the quick assimilation and application of theoretical teachings are afforded by the readiness with which fruit-growers within the last decade have adopted the ideas associated with tillage, spraying, pollination, fertilizing and pruning. Yet, great as have been the advances, progress has only begun: one advance leads to another. Pictures of typical American fruit-plantations may be found under *Grape, Horticulture, Olive, Orange, New York, Peach, Plum*, etc., and others are shown in Figs. 1890–1895.

1892. Double planting, showing bush-fruits growing between the trees.

This is to be discouraged as a general practice, but it may be successful when high culture and extra care are given.

The American ideals in Pomology are quite unlike the European. The American aims at uniformity over large areas. The European gives more attention to special practices, particularly in training of fruit-trees. This is well illustrated in American nurseries as contrasted with European nurseries (see *Nursery*). The American merely prunes his fruit trees in the nursery: he does not train them. The American ideal in nursery stock is shown in Fig. 1896. See *Pruning*.

In nearly all parts of the country the extension of fruit-growing is the most radical change of base now taking place in farming operations. This growth of the fruit business is possible, because the consumption of fruit is increasing amongst all people, the facilities for transportation have been improved, scientific discovery has insured the production of good crops, and because many other kinds of farming have been relatively unprofitable. Unfortunately, there are no complete statistics yet published of the pomological resources of the United States or Canada.

Whilst the phenomenal development of American pomology has been due in great measure to climatic and economic conditions, it also has been hastened by book writings. No less than fifty authors have contributed books of greater or less size, either on the general subject or on special fruits, beginning with Coxe's "View of the Cultivation of Fruit Trees" in 1817, and followed by Thacher's "American Orchardist" in 1822. These pioneer writings gave much of their space to orchard management, with little mere compilation of descriptions of varieties. Subsequent volumes, for nearly fifty years, were in large part compilations and collations of accounts of varieties. To this latter class belong the works of Prince, Kenrick, Downing, Thomas, Warder. It is only in the present time that we have come to treat the subject fundamentally, by giving the weight of discussion to principles of orchard management. For further discussion of books, see the article *Horticulture*.

1891. Young plum orchard, showing clean tillage and high-heading.

Some growers head-in vigorous young trees like the above, but others prefer to let them take their natural course, keeping the heads open rather than thick and close. Neither method is best under all circumstances. See *Pruning*.

The evolution of our pomology is well illustrated in the radical change of ideals within the last quarter century. These new points of view may be arranged conveniently under seven general heads:

1. The most important point of view connected with our commercial pomology is the fact that there is a horticultural industry as distinguished from a general agricultural industry. At the opening of the nineteenth century our agriculture was more or less homogeneous, largely because the extent of it was limited and because there was little demand for other than the few staple commodities. The horticulture of that time was confined chiefly to a small area about the homestead. A few vegetables, flowers and fruits in a small plantation, with here and there a single greenhouse, represented the horticultural effort of the time. At the present day we conceive of whole states and of entire geographical areas as horticultural regions. Persons now buy farms with the explicit purpose of devoting them to the production of fruits or other horticultural products. Even fifty years ago horticulture was largely an amateur's avocation, but to-day it is one of the leading commercial occupations of the country, and the most important single factor in it, in America, is pomology. With this rise of the horticultural industries came a demand for new knowledge respecting a host of subjects which were undreamed of even as late as a half century ago. The cotemporary progress in pomology is largely a breaking away from the old ideals. Those persons who are still laggards are the ones who are holding to the point of view of a generation ago. Practices that were good enough for amateur purposes, or for the incidental and accidental fruit-growing of our fathers, may be wholly inadequate to the new-time conditions. At the opening of the century there was practically no commercial orcharding. The apple was grown somewhat extensively in many parts of the country, particularly in New England, but it was used chiefly for the making of cider. Small-fruit growing, as a business, had not developed. In fact, commercial strawberry-growing may be said to have begun

1893. A vineyard of American grapes (New York). Picking-crates are shown in the foreground.

with the introduction of the Hovey in 1836, although there were market plantations of small extent about some of the larger towns. The commercial culture of blackberries and raspberries, although it began about the middle of the century, did not acquire distinct importance until after the reaction from the Civil War. The very fact that there is a horticultural industry is a most important innovation in our agricultural status.

1894. Harvest time in the apple orchard.

2. With the rise of commercial pomology there have developed all those questions which are related to marketing. The new market ideals cluster about three centers: (1) The demand for special products for special uses, (2) the growing demand for small packages, and (3) the remarkable evolution of transportation facilities, and of cold storage. There has arisen an increased desire for special grades and for particular kinds of fruit. The fruits that were current fifty years ago may not be good enough for the markets of to-day. Commercial pomology rests on the fact that more people are consuming fruits. Many of these people buy only in small lots for present consumption. They go to the market often. They have no facilities for storing the fruit, and they do not buy for the purpose of selling. Therefore the small package has come to be increasingly more important. Fig. 1897. Within the last twenty-five years there has been an increasing demand for a package that can be given away with the fruit. This demand for the small and individual package may be expected to increase with all the better kinds of fruits or with those that appeal to the personal customer. This is true in all lines of trade. Twenty-five years ago boots and shoes were distributed in large board cases, but now each pair is sold in a neat cardboard box. We are still too conservative in respect to the handling of apples in barrels. In the general trade and for the staple varieties of apples the barrel may be the best package, but for the personal customer and particularly with all the finer or dessert varieties, a small package must come into use. It is, in fact, a question whether the bushel box would not be better for even the staple apple trade. In most parts of the world, except in the central and eastern part of the United States, apples are not handled in barrels. The very fact that the grower must give attention to his package as well as to the growing of his crop, forces him to adopt a new point of view in his fruit-growing.

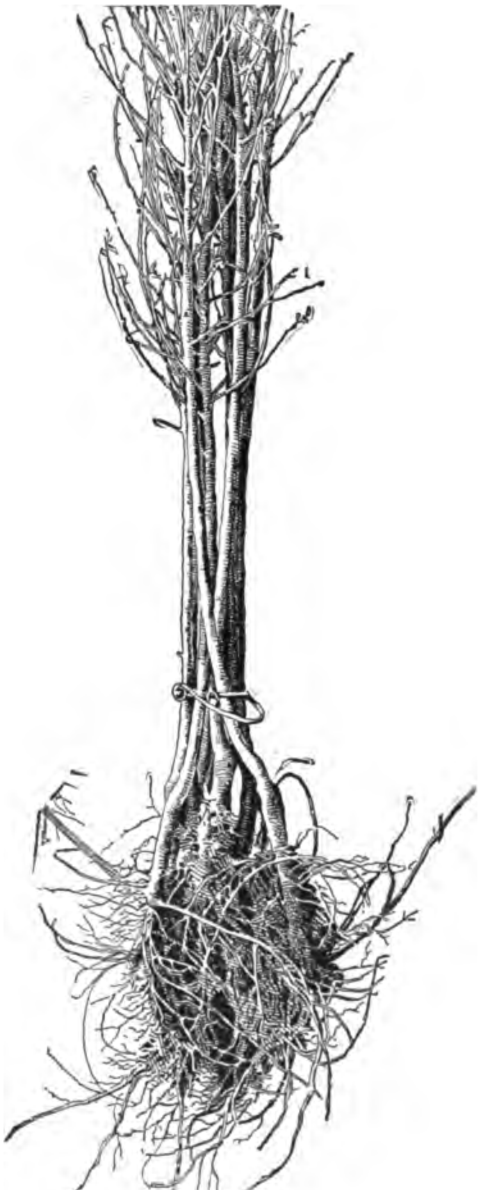
3. Modern commercial orcharding has developed the tillage ideal. Under the old régime the tree was able to take care of itself and to bear a produce good enough to meet the uncritical demands. Nowadays, however, the tree must receive the very best of care, for we desire annual crops of great quantity and of the best quality. Therefore the plant must be supplied with abundance of plant-food and moisture. Time was when it was thought that the mere application of chemical plant-food to the soil would be sufficient to make a plant productive. It is now understood, however, that plant-food is only one of the requisites of good growth. The soil must be deep and loose and fine, so that it will hold moisture and promote all those chemical and biological activities which make the land productive. In former times the best attention in tillage was given to the annual crops. The orchard was usually in neglect. This was because the fruit plantation had small commercial importance. Now that the fruit plantation has risen to first importance, in many cases, it must be given as good care as any farm crop. In recent years there has been great development of special tools and implements for the tillage of orchard lands. Greater attention is given to the original preparation of the land, so that planters no longer ask how large the hole must be to receive a tree, but accept Warder's advice that the hole should be as large as the orchard. The philosophy of orchard tillage, as understood by the best teachers and for most parts of the country, is (1) to prepare the land thoroughly at the outset, (2) to give frequent light surface tillage in the early part of the season or until the crop is nearly or quite grown, and then (3) to cover the land with some crop that will remain on the ground over winter and can be plowed under in spring. If the land has been well prepared it is not necessary to plow it deep after the first two or three years, unless one is turning under a heavy cover-crop.

1895. Lunch time in the apple harvest.

The surface tilth may be secured by breaking the top-soil early in spring with a cutaway harrow, gang plow or other surface-working tools. This may not be possible, however, on very heavy lands. The cover-crop adds humus and protects the land from puddling and baking in the winter. If it is a leguminous crop it also adds a store of available nitrogen. It is possible, in many cases, to use cover-crops so freely, particularly of the leguminous kind, that the land becomes too rich in nitrogen and the fruit plants make too heavy growth. Usually the cover-crop is plowed under in spring at the very earliest opportunity in order to save the soil moisture. It is by no means the universal practice to use cover-crops on fruit lands, but the idea has come to stay, and the grower may adopt it or not as his judgment dictates. In order to facilitate the economical and efficient tillage of fruit lands, it is coming to be the practice to devote the land wholly to the fruits. With plums and pears and some other orchard fruits, it is often allowable to use the land for the first two or three years for annual crops, but these crops should gradually diminish and every caution should be taken that they do not interfere with the care of the trees. Apple orchards, when the spaces are 40 feet apart, may be cropped for six or eight years without injury, providing good tillage and other efficient treatment are given. One reason for allowing orchards to stand in sod in the old times was that it was difficult to plow beneath full-grown trees. Those persons who desired to plow and till their orchards, therefore, advocated very high pruning. The difficulty with these old orchards was the fact that the land was allowed to run into dense sod. Heavy plowing in an old orchard indicates that the plantation has been neglected in previous years. Orchards that have been well tilled from the first do not require much laborious tillage, and the roots are low enough to escape tillage tools. In recent times, there has been an evolution of tillage tools which will do the work without necessity of pruning the tops very high. Within the last ten years, at least in the eastern states, the practice of tilling orchards has increased rapidly. At first it was advised by a few growers and teachers, but the movement is now so well established that it will take care of itself, and in the commercial orchards of New York state, at least, the man who does not till his orchard is the one who needs to apologize. On the Pacific coast, the importance of tillage is universally recognized, because of the dry summer climate. The necessity of tilling orchards has forced a new ideal on the pomologist; and when he goes to the expense of tilling he feels the necessity of giving sufficient care in other directions to insure profitable returns from his plantation.

4. More and more, as competition increases, is it necessary to give attention to pruning. It is unfortunately true that trees will bear without pruning. This, therefore, puts a premium on neglect. The old practice allowed the tree to grow at will for three or four years and to become so full of brush that the fruit could not be well harvested, and then the top was pruned violently. The result was that the tree was set into redundant growth and was filled with water-sprouts. This tended also to set the tree into wood-bearing rather than into fruit-bearing. By the time the tree had again settled down to fruit-bearing the orchardist went at it with ax and saw and a good part of the top was taken away. It is now understood that the ideal pruning is that which prunes a little every year and keeps the tree in a uniformly healthy and productive condition. The pruning of trees has now come to be a distinct ideal, and this ideal must gain in definiteness and precision so long as fruit trees are grown. See the article *Pruning*.

5. Now that there is demand for the very best products, it is increasingly more important that fruits be thinned. The thinning allows the remaining fruits to grow larger and better, it saves the vitality of the tree, and it gives the orchardist an opportunity to remove the diseased specimens and thereby to contribute something toward checking the spread of insects and fungi. Thinning is exceedingly important in all fruits that are essentially luxuries, as peaches, apricots and pears. It is coming also to be more and more important for apples and for others of the cheaper fruits. In the thinning of fruits, there are always two rules to be kept in mind: (1) Remove the injured, imperfect or diseased specimens; (2) remove sufficient fruit so that the remaining specimens stand at a given distance from each other. How far apart the fruit shall be, will depend on many conditions. With peaches it is a good rule not to allow them to hang closer than four or five inches (sometimes 7 or 8 in.), and in years of heavy crops they may be thinned more than this. This amount of thinning often removes two-thirds of the fruits. It nearly always gives a larger bulk of fruit, which brings a higher price.



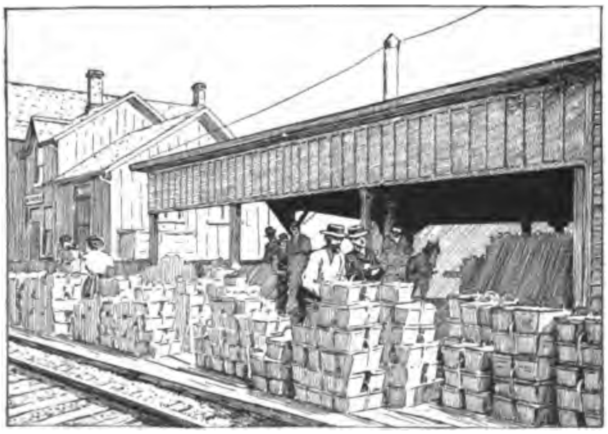
1896. The American ideal in nursery stock,—large, straight, uniform, high-topped trees.

Thinning is usually performed very early in the season, before the vitality of the tree has been taxed.

6. Spraying of fruit plantations has now come to be a definite ideal. Within the last ten years it has come to be an established orchard practice; no good orchardist is now without his spraying apparatus any more than he is without his tillage tools. When spraying was first advised, the practice seemed to be so revolutionary that great emphasis had to be laid on its importance in order to induce people to undertake it; therefore it may have been emphasized more than its importance justified. This, however, is necessary with all new enterprises. How and when to spray and what materials to use are matters that will always be discussed, because the practices must vary with the season, the kind of fruit, the geographical region, the insects and fungi to be combated. Spraying may not be necessary every year, and certainly not equally necessary in all geographical regions; but the fact that spraying is necessary as a general orchard practice is now completely established. Fig. 1898. See *Spraying*.

7. Perhaps the most gratifying modern development in our pomology is the demand for instruction in fundamental principles. Years ago, the pomologist was satisfied if he had definite directions as to how to perform certain labor. He was told what to do. At the present time, the pomologist wants to be told what to think. There seems to be a tendency in horticultural meetings to drop the discussion of the mere details of practice and to give increasingly more attention to the fundamental reasons and the results that are to be expected from any line of practice. Knowing why a thing should be done and what the results are likely to be, the pomologist can work out the details for himself, for every fruit plantation and every farm is a law unto itself.

SYSTEMATIC POMOLOGY.—The classifying and describing of the kinds of fruits is a particular kind of pomological knowledge that is left to specialists, who are for the most part writers. With the augmentation in numbers of varieties, it becomes increasingly more important that the most careful attention be given to describing them and to assembling them into their natural groups in order that similar kinds may be compared and that it may be possible to determine the name by analyzing the specimen. Necessarily, all classificatory schemes for varieties are very imperfect since the varieties often differ by very slight characters, and these characters may vary in different regions and under varying conditions. Theoretically the most perfect classification is one that considers characters of flowers as well as of fruits, but such schemes are usually impracticable because fruit-growers cannot secure flowers and fruits at the same time. For examples of classificatory schemes the reader may consult the various fruit manuals, but the following examples will show something of the range and method connected with the problem:



1897. The small gift fruit package.—Scene at a railway station.

The following is John J. Thomas' scheme for classifying peaches:

Division I. FREESTONES or MELTERS.
  Class I. *Flesh pale* or *light-colored.*
    Section I. Leaves serrated, without glands.
    Section II. Leaves crenate, with globose glands.
    Section III. Leaves with reniform glands.
  Class II. *Flesh deep yellow.*
    Section I. Leaves crenated, with globose glands.
    Section II. Leaves with reniform glands.
Division II. CLINGSTONES or PAVIES.
  Class I. *Flesh pale* or *light-colored.*
    Section I. Leaves serrated. without glands.
    Section II. Leaves crenate, with globose glands.
    Section III. Leaves with reniform glands.
  Class II. *Flesh deep yellow.*
    Section I. Leaves serrate, without glands.
    Section II. Leaves with reniform glands.
  Class III. *Flesh purplish crimson.*
    Section I. Glands reniform.

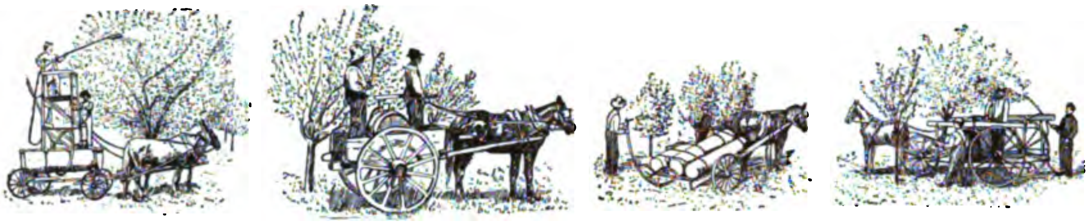
Following is John A. Warder's scheme for classifying apples, adopted "after a long and careful consideration and study of this subject." See Fig. 1899.

Class I. *Oblate* or *flat*, having the axis shorter than the transverse diameter.
  Order I. *Regular.*
  Order II. *Irregular.*
    Section 1. Sweet.
    Section 2. Sour.
      Subsection 1. Pale or blushed, more or less, but self-colored and not striped.
      Subsection 2. Striped or splashed.
      Subsection 3. Russeted.
Class II. *Conical*, tapering decidedly toward the eye, and becoming *ovate* when larger in the middle and tapering to each end, the axil diameter being the shorter.
  Orders I and II.
    Sections 1 and 2.
      Subsections 1, 2 and 3.
Class III. *Round, globular* or nearly so, having the axial and transverse diameters about equal, the former often shorter by less than one-quarter of the latter. The ends are often so flattened as to look truncated, when the fruit appears to be cylindrical or globular-oblate.
  Orders, Sections and Subsections as above.
Class IV. *Oblong*, in which the axis is longer than the transverse diameter, or appears so. These may also be truncate or cylindrical.
  Orders, Sections and subsections as above.

Robert Hogg's classification of Pears ("Fruit Manual," 5th ed., London) is as follows:

A. The length from the base of the stalk to the base of the cells greater than from the base of the cells to the base of the eye.
  Section 1. Length from the base of the stalk to the base of the eye greater than the lateral diameter.
  Section 2. Length from the base of the stalk to the base of the eye less than the lateral diameter.
  Section 3. Length from the base of the stalk of the base of the eye equal to the lateral diameter.
B. Length from the base of the stalk to the base of the cells less than from the base of the cells to the base of the eye.
  Section 1. Length from the base of the stalk to the base of the eye greater than the lateral diameter.
  Section 2. Length from the base of the stalk to the base of the eye less than the lateral diameter.
  Section 3. Length from the base of the stalk to the base of the eye equal to the lateral diameter.
C. Length from the base of the stalk to the base of the cells equal to that from the base of the cells to the base of the eye.
  Section 1. Length from the base of the stalk to the base of the eye greater than the lateral diameter.
  Section 2. Length from the base of the stalk to the base of the eye less than the lateral diameter.
  Section 3. Length from the base of the stalk to the base of the eye equal to the lateral diameter.

A stable and attractive systematic pomology must give careful attention to the names of varieties. In North America much has been done, particularly under the auspices of the American Pomological Society, to simplify and codify the ideas associated with the nomenclature of fruits. The latest set of rules for the naming of horticultural varieties is that proposed by the Cornell Horticulturists' Lazy Club, and first published in American Gardening Oct. 15, 1898 (see also Waugh's pamphlet on "Horticultural Nomenclature"):



1898. Various spraying rigs.

1. A tall platform rig, to enable one to spray very high trees. 2. A simple barrel outfit for small orchards and small trees. 3. Compressed air outfit. 4. A low rig, with barrel.

PROPOSED CODE FOR POMOLOGICAL NOMENCLATURE.

Form of Names.

1. The names of a variety of fruit shall consist of one word, or at most of two words.

(*a*) In selecting names, simplicity, distinctiveness and convenience are of paramount importance. Pitmaston Green Gage and Louise Bonne de Jersey are neither simple nor convenient. Gold, Golden, Golden Drop, Golden Beauty and Golden Prune, all given to different varieties of plums, are not distinctive.

(*b*) The use of such general terms as seedling, hybrid, pippin, buerre, damson, etc., is not admissible.

(*c*) Nouns must not be used in the possessive form. McIntosh's Red, Crawford's Early, Bubach's No. 5, must be written McIntosh Red, Crawford Early and Bubach.

The name of no living horticulturist should be applied to a variety without his consent.

(*d*) Numbers are to be considered only as temporary expedients, to be used while the variety is under trial.

(*e*) An author publishing a new variety should use the name given by the originator, or by the introducer, or else should choose the oldest discoverable local name, providing such name may be conformed to these rules without loss of identity.

2. In the full and formal citation of a variety name, the name of the author who first published it shall also be given.

(*a*) Names would then take such forms as the following: Summer Queen, Coxe, or Sophie (J. W. Kerr, Cat., 1894); or America, Burbank, New Creations, 1898, p. 5.

(*b*) It is expected that such citations of names will be used only in elaborate works on pomology, in scientific publications, or in cases where they are necessary for clear discrimination of synonyms.

Priority.

3. No two varieties in the same group shall have the same name, and the name first published for a variety must always be used to designate it. All names subsequently published must stand as synonyms.

(*a*) The term "group" as here used shall be held to designate the large general groups specified by words in common language, such as raspberry, plum, apricot.

Publication.

4. Publication consists in the public distribution of a printed name and description, the latter giving distinguishing characters of fruit, tree, etc., or in the publication of a new name for a variety properly described elsewhere.

(*a*) Such a publication may be made in any book, bulletin, report, trade catalogue or periodical, providing the issue bears the date of its publication, and is generally distributed among nurserymen, fruit-growers and horticulturists.

Revision.

5. No one is authorized to change a name for any reason except when it conflicts with these rules.

There are relatively few special technical terms used in the descriptions of pomological fruits. The greater part of them pertain to the pome fruits. The diagrams (Figs. 1899, 1901) illustrate some of these terms: ***Spherical,*** nearly or quite globular, the two diameters being approximately equal; ***conical,*** longitudinal diameter equaling or exceeding the transverse diameter, and the shoulders or apex somewhat narrowed; ***ovate,*** broad-conical, the base more rounded; ***oblong,*** longitudinal diameter distinctly the longer, but the fruit not tapering; ***oblate,*** distinctly flattened on the ends. In Fig. 1900 is shown the typical form of the pear, a shape known as ***pyriform.*** In the true Japanese or Sand pears, the fruit is usually apple-form. (Fig. 1680.) In Fig. 1901 are shown special parts of the fruit: ***basin,*** the depression at the apex, in which is the *calyx* or *eye; cavity,* the depression at the base, in which is the stem or ***stalk; suture,*** or the groove on the side of plums and other fruits; *corrugated* or *furrowed* sides.

If descriptions are to be accurate and comparable, they should characterize all the leading or designative attributes of the fruit, and to a less extent of the plant as a whole. Many persons who are called on to describe varieties have adopted "forms" or regular outlines, in order that all characterizations in any one fruit shall be comparable. The following forms, adopted by Professor Craig, illustrate the points that a good description should cover:

Name..

form .... ***size*** ....

cavity........................ ***stem*** ....

suture........................ ***apex*** ....

skin........................ ***color*** ....

flesh .... ***juice*** ....

stone........................ ***quality***........................

flavor........................ ***season***........................

TREE ....

GENERAL NOTES..

....

....

....

....

Specimens received from........ ***Described by***........ ***Date***.......

CHERRY .... ***Group.***

Name..

size .... ***form*** ....

color........................ ***skin***........................

cavity........................ ***stem*** ....

basin........................ ***calyx***........................

flesh .... ***quality***........................

texture........................ ***core*** ....

seed..

season..

TREE ....

GENERAL NOTES..

....

....

....

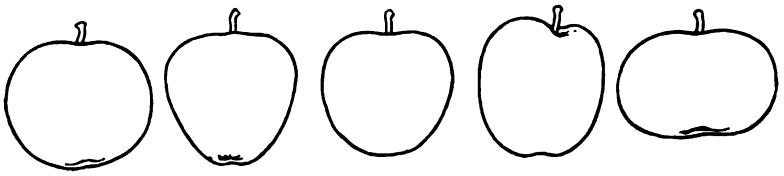
....

Specimens received from........ ***Described by***........ ***Date***.......

APPLE ....

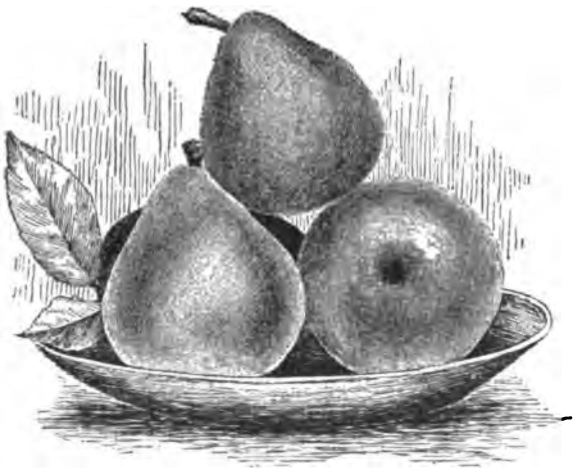
The sources of American pomology—of the species and races of fruits that we cultivate—are chiefly four: (1) Original or early importations of western Asian and European fruits; (2) oriental types, from the China-Japanese region; (3) the introduction in recent years of fruits from the Russian region; (4) the development of native species. In the first group are included the prevailing types of apples, pears, quinces, cherries, domestica plums, olives, currants, some of the gooseberries. In the second group are citrous fruits, peaches, apricots, Japanese plums, kaki, and others, many of them having come to us by way of Europe. In the third class—the Russian fruits—are types of orchard fruits of such recent introduction amongst us that we have not yet ceased disputing about their merits and demerits; therefore a special review of the subject is made below. The fourth class—the native fruits—includes the grapes of the eastern states, blackberries, raspberries, many gooseberries, strawberries (of Chilean origin), many plums, cranberries, and a few apples. Histories of these fruits may be found in the writer's "Sketch of the Evolution of our Native Fruits."

L. H. B.



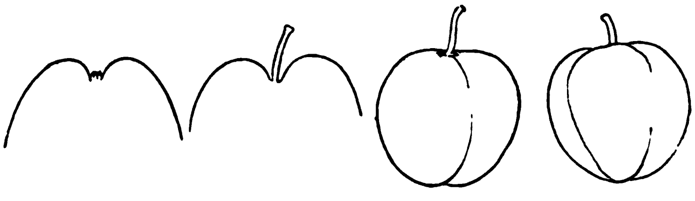
1899. The forms of fruits.
Showing, respectively, spherical, conical, ovate, oblong and oblate forms.

Russian Fruits.—The Russian apples and their close relatives, the Siberian crabs and their hybrids, constitute the hardiest types of pomaceous fruits in cultivation. It was the demand for hardy varieties for the northwestern states and Canada that led to their wholesale introduction into this country.



1900. The pyriform shape, typical of the fruits of Pyrus communis.

Historical.—There are four varieties of Russian apples that may be looked on as American pioneers; these are Alexander, Tetofsky, Duchess (Borovitsky) and Red Astrachan. These varieties were imported by the Massachusetts Horticultural Society from the London (England) Horticultural Society about 1835. They were brought to England from Russia in the early part of the last century by the executive of the latter society. Dr. Hogg is authority for the statement that Alexander was cultivated for 50 years in England prior to 1808. Robert Manning, superintendent of the test garden of the Massachusetts Horticultural Society at Salem, described these varieties from home-grown American specimens in 1839. Their productiveness and the handsome appearance of the fruit attracted attention. Through the efforts of Dr. Warder and other western pomologists they were rapidly distributed throughout Ohio, Wisconsin and Minnesota. It would appear that during the last half century — which practically covers the pomological history of the West—the periodicity of "hard" or "test" winters has been more or less regular. When the normal or "mild" winter obtains, the apples of the New England states or their descendants do not, as a rule, suffer injury except in the colder parts of Minnesota. These mild winters have followed each other with delusive regularity for periods of ten, fifteen or eighteen years. Under these conditions fruit-growers have been prone to efface from their memories the effects of the last "test winter" and have planted freely of the American type. With this type have been usually mingled Alexander, Oldenburg and Red Astrachan. It has been invariably noted that after the visitation of an exceptionally cold winter varieties of the Oldenburg or Alexander types were usually unharmed, while Greening, Janet, and Baldwin were killed. "Test winters"—the name has more or less local adaptation in the West—visited the northwestern states in 1855–6, 1872–3, 1885–6, and lastly in 1898–9. Thus it is that Oldenburg (Duchess) has become a standard of hardiness among apples in the colder parts of the United States and Canada. Importations of cions were made by nurserymen and fruit-growers between 1867 and 1875, but the main introduction was made by the U. S. Department of Agriculture in 1870 at the urgent request of the State Agricultural Society of Minnesota, which began the agitation as early as 1867. This importation consisted of young trees secured through the coöperation of Dr. Edward Regel, director of the Imperial Botanic Gardens at St. Petersburg. The trees were planted on the grounds of the Agricultural Department at Washington. The collection consisted of about 300 varieties. They were taken charge of by the late William Saunders, superintendent of gardens and grounds. All available cions were cut and distributed annually for five years. They attracted considerable attention in the colder apple-growing regions. Subsequent importations of cions and trees were made by the Iowa Agricultural College between 1875 and 1880. In 1882 Charles Gibb, of Abbotsford, Canada, accompanied by Prof. J. L. Budd, of the Iowa Agricultural College, went to Russia and spent the summer in investigating these fruits. Large importations of apples, plums, pears and cherries followed. In these later importations the east-European fruits were collected without discrimination, and in most instances have been erroneously regarded in this country as authentic Russians.



1901. Illustrating special terms used in describing fruits.
Showing, respectively, basin, cavity, suture, corrugation.

Apples: Characteristics and Nomenclature.—It is now very difficult to say which are Russian apples and which German, Polish or Swedish. If we were to select the Astrachan variety as a type of the Russian apple, which in all probability would be a correct basis, only a comparatively small number of varieties could be grouped about it. But this is only one of the several apparently authentic groups which might be erected upon certain characteristics of tree. In addition to Astrachan we might cite (1) Hibernal type: trees vigorous growers, with open spreading tops, and very large, leathery leaves. (2) Oldenburg type: moderate growers, with compact, round-topped heads; lvs. of medium size. (3) Longfield type: slow growers; branches horizontal or pendulous; lvs. whitish and woolly underneath. The Longfield apple, now one of the most popular of the Russians, is shown in Fig. 1902. (4) Transparent and Tetofsky type: trees pyramidal; bark yellow, with numerous spurs; lvs. large, light green. (5) Anis type: trees upright, spreading or vase-shaped; lvs. medium, veins reddish. It would seem reasonable to suppose that the Anis family was derived from the Astrachan type. The flesh of the fruit of the various types is very similar.

These represent the principal types of Russian apples. The fruit they bear in this climate matures in the summer, autumn or early winter. It does not appear that any of the especially hardy varieties of undoubted north or east Russia origin are winter kinds when grown in the Mississippi valley. Such late-keeping kinds as give promise of commercial value appear to have originated in the Baltic provinces or to have been transported at an early date from the countries to the west. These types—the Synaps for instance—have characteristically small leaves, slender twigs, and are less hardy than members of the groups cited above.

The "bloom," or glaucous covering, of the Russian apple is characteristic. It does not persist to the same extent, however, under all climatic conditions. In eastern Quebec it fails to develop to the same extent that it does under the drier atmospheric conditions of the eastern states. As additional proof that this pruinose bloom is an immediate climatic effect, we have but to compare the Colorado Spy with that grown in New York. The smooth, thin skin and abundant bloom of the Colorado apple is characteristic in a greater or less degree of all varieties produced in the dry regions adjacent to the Rockies, as it is of the Russian apples in the more arid portions of that country.

The names of Russian apples are much confused. There is no pomological society in Russia to assist the fruit-grower in eliminating synonyms; on the other hand, the factors conducive to confusion are strongly in evidence. These are illiteracy on the part of the grower and the practice of propagating fruit trees from the seed instead of by grafting. Gibb says "nomenclature in Russia is hopelessly confused. Different names are given to the same apples in different localities, the same name to different apples growing in adjacent districts."

Fruit-growers of the West, realizing that Americans should have a uniform system, at least in the nomenclature of these varieties, called a meeting made up of interested representatives of the fruit-grower's associations of South Dakota, Minnesota, Iowa and Wisconsin. These delegates, collectively styled the "Russian Apple Nomenclature Commission," met at La Crosse, Wis., Aug. 30–31, 1898. They decided that it would be wise to attempt a grouping to be based upon "family resemblance." In accordance with this the following statement was adopted: "The varieties here grouped as members of the same families, while in a few cases differing somewhat in characteristics of tree, are so nearly identical in fruit that for exhibition and commercial purposes they are practically the same and should be so considered." It is to be regretted that a commission on nomenclature should take such a radical stand as this, because the characteristics of a variety cannot be changed by voting to call it by the same name as the other member of the group which it most resembles and almost, though not quite, duplicates. The trend of modern pomology is to preserve small differences, to differentiate rather than blend. The work of the future will consist in large part in studying small differences with a view of finding closer adaptations. The propriety of ignoring Russian nomenclature and the rule of priority is questionable, but in a measure is defensible on the grounds of a confused Russian nomenclature and the unpronounceableness of Russian names. The findings of the committee have on the whole met with the approval of those interested in Russian apples.

1902. Longfield, one of the popular Russian apples (X ⅓).

Cherries.—These, next to the apples, constitute the most clearly defined group of Russian fruits; yet many cherries commonly called Russian are in reality Polish, Silesian or German. The typical cherry of northern Russia is represented by the Vladimir type. Fig. 1903. This was first introduced into America as a distinct variety. Later importations and experience demonstrated that Vladimir was a type, not a variety. This type appears to have been grown in Russia for centuries from seed and sprouts. In this way a special class has been developed. The Vladimir type is characterized by its dwarf stature—5–8 feet high—its peculiarly rounded and compact top, its dark red, meaty-fleshed fruit. Koslov-morello is evidently a light-colored juicy variety of Vladimir. The characteristics of the tree are the same as Vladimir, although when grown from seed in this country the seedlings exhibit considerable variation. The amarelles and weichsels of Germany have been grown in Russia for centuries, generally from seed, and have become specialized forms. Cherries of the Vladimir and Koslov-morello types are the hardiest of

1903. Vladimir, one of the typical Russian cherries (X ⅔). The fruit is somewhat tapering to the stem.

the cherries. The Vladimirs have not, as a rule, been productive in this country. The fruit-buds appear to be sensitive to cold and as easily injured as some of the recognized tender types of cherries. Although the trees are hardy, the introduction of this type has not extended the area of commercial cherry-growing in this country farther north than the regions already outlined by the profitable cultivation of Early Richmond.

Plums.—The plums imported from Russia do not differ materially from those of the domestica type in cultivation in this country. The trees are probably somewhat hardier than Lombard or Green Gage, but the fruit-buds are subject to winter injury wherever Lombard is uncertain. In the main they have been unproductive. Among the most widely tested varieties are Early Red, Moldavka and Merunka, all of the Lombard type. See Figs. 1853–5.

Pears.—These are hardy handsome trees, but none bear fruit of good quality. Where blight is prevalent they are extremely susceptible; while uninjured by extreme cold, blight kills them off rapidly. Among the hardiest of the class are Bessimianka (meaning seedless, which is only partly true), Gakovsky and Tonkovietka. These thrive wherever the climate admits of the cultivation of the Oldenburg apple. The fruit ripens in August, and rots at the core if allowed to mature on the tree.

Apricots were brought to Nebraska and Kansas by Russian Mennonites about twenty-five years ago. A few of those named and distributed are likely to be retained in the fruit lists of the West.

Russian mulberries (Fig. 1904) have been widely sold as fruit-bearing plants by enterprising agents, but their use to the fruit-grower should be restricted to hedging and the formation of wind-breaks. For these purposes they are valuable in the colder and more rigorous regions.

Peaches.—So-called hardy Russian peaches are sold, but they really belong to Bokara or Turkestan. The peaches of the Baltic provinces do not differ essentially from the ordinary Persian strain in form or hardiness.

The introduction of the Russian fruits has given us hardy types from which to breed varieties for northern latitudes. In Iowa, Minnesota and Wisconsin this work is under way. Seedlings and hybrids are appearing each year, which may be considered valuable additions to the fruit lists of these regions.

Literature.—But two books appear to have been written on Russian pomology up to 1868, one by Nicolai Krasno Glasov, 1848, the other by Dr. Regel, director of the Imperial Botanic Gardens, St. Petersburg, in 1868. The latter is called "Russkaya Pomologaya." It contains a description of 225 varieties of apples, nearly all of Russian origin. A wood-cut of each appears, in addition to 144 colored plates. Gibb calls it "a grand, good fundamental work." American literature on Russian fruits is mainly confined to three sources: the reports of the Montreal Horticultural Society, publications of the Division of Pomology, Department of Agriculture, Washington, and Bulletins of the Horticultural Department of the Iowa Agricultural College. To Charles Gibb, Abbotsford, Can. (Quebec), we are indebted for the faithful and accurate translation of the names given in the collection imported by the Department of Agriculture in 1870. This was adopted by the American Pomological Society in 1885. JOHN CRAIG.

1904. Russian mulberry (× ⅓).
The plant is very variable in character of fruit and in shape of leaves. See *Morus*.

POND-APPLE is *Anona glabra*. **Pond Lily.** *Nuphar*. **Pond-weed.** *Potamogeton*.

1905. Pickerel-weed—Pontederia cordata.

PONTEDÈRIA (G. Pontedera was an Italian botanist, 1688–1757). *Pontederiàceæ.* According to Engler (DC. Monogr. Phaner. 4, p. 531) there are two species of Pontederia. *P. cordata*, with several varieties, occurs in both North and South America; *P. rotundifolia* is native from Nicaragua to Argentina. Perennial herbs of bogs and ponds, with strong horizontal rootstocks, short spikes of showy blue flowers and mostly cordate-oblong or ovate mostly, shining leaves. The North American **P. cordàta**, Linn., PICKEREL-WEED (Fig. 1905), is common east of the Plains region on the borders of ponds and along the margins of slow streams. It is a strong-growing perennial, standing in clumps and sending up several strong stems (from well-established plants) 2–4 ft. tall, each stem bearing 1 cordate-ovate leaf-blade and usually several leaf-sheaths: fls. light blue, somewhat 2-lipped, with 6 linear-oblong and spreading lobes, the middle upper lobe yellow-spotted at the base inside; stamens 6, trimorphous; ovary with 3 locules, 2 of which develop no seeds: fr. a 1-seeded utricle. Pontederias are well worth cultivation in bog gardens and shallow ponds, and *P. cordata* is offered by dealers in native plants. It thrives best in water 10–12 in. deep. It transplants with ease. Propagated mostly by division. It grows as far north as Nova Scotia and Minnesota, and therefore is perfectly hardy in all parts of the country. B.M. 1156. G.W.F. 45. Mn. 7:1. V. 2:196; 3:336. For *P. crassipes*, see *Eichhornia speciosa*.

L. H. B.

PONTHIÈVA glandulòsa is a West Indian terrestrial orchid with small greenish flowers. It was advertised in 1881 by E. Gillett, of Southwick, Mass., but it is probably not hardy North, and does not appear to be in the trade now. It is figured in B.M. 842 as *Neottia glandulosa*.

POOR MAN'S WEATHER GLASS. *Anagallis arvensis.*

POOR ROBIN'S PLANTAIN. *Erigeron bellidifolius.*

POP CORN. See *Corn*.

POPE'S HEAD. *Melocactus.*

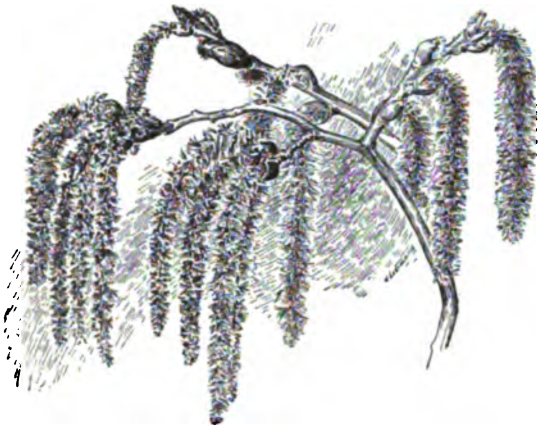
POPINAC is *Acacia Farnesiana.*

POPLAR. See *Populus.*

POPLAR, YELLOW. *Liriodendron.*

POPPY. *Papaver.* **California P.** is *Eschscholzia.* **Celandine P.** *Stylophorum.* **Corn P.** *Papaver Rhœas.* **Horned P.** is *Glaucium.* **Opium P.** is *Papaver somniferum.* **Prickly P.** See *Argemone.* **Shirley P.** is the finest strain of *Papaver Rhœas.* **Tulip P.** *Hunnemannia.* **Welsh P.** See *Meconopsis Cambrica.*

POPPY MALLOW is *Callirhoë.*



1906. Staminate catkins of Populus tremuloides (× ⅓).

PÓPULUS (ancient Latin name). POPLAR. ASPEN. From 20 to 25 soft-wooded trees of mostly small or medium size in the northern hemisphere, and which, with Salix, comprise the family *Salicàceæ.* The Poplars are diœcious, with both staminate and pistillate flowers naked and in slender mostly drooping catkins in which the scales are cut or cleft at the apex: stamens few or many, usually numerous, on distinct filaments: pistillate fls. comprising a single 1-loculed mostly sessile ovary with short style and 2–4 often lobed long stigmas: fr. a small 2–4-valved capsule, containing cottony seeds: lvs. alternate, stalked, mostly broad: buds scaly, often resinous. The Poplar of lumbermen is the tulip-tree. (See *Liriodendron.*)

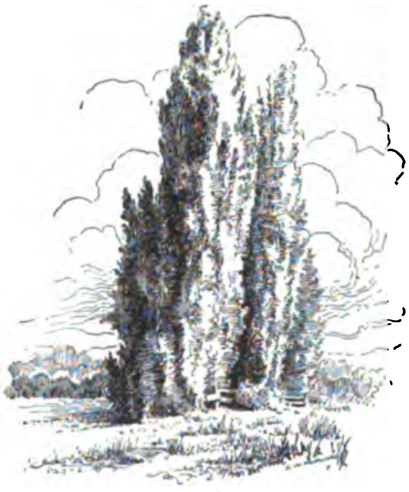
The Poplars are amongst the easiest of all trees to grow. They grow readily from hardwood cuttings, as willows and currants do. The weeping varieties are grafted head-high on erect kinds, *P. grandidentata* being much used as a stock. Poplars thrive in almost any soil, although the Cottonwood is most at home in lowlands and along streams, at least in the East. For shelter-belts they are very useful because of their rapid growth and great hardiness. In the prairie states some of the Russian Poplars (particularly the form known as *P. Certinensis*) are now popular, because they withstand the trying winters. The Poplars are also useful for temporary shelter for other trees and bushes. In this respect the common Aspen (*P. tremuloides*) is one of the most valuable of all trees in the reforestation of American lands. It springs up quickly in clearings, and during its comparatively short life holds the soil and protects other vegetation and finally contributes its own substance to the maintenance of the stronger forests. In this way it has exerted a most powerful effect upon the configuration of our forest areas and upon the fertility of the land from remote time. The same qualities make it valuable, in many instances, in extensive ornamental plantings.

The fault in the planting of Poplars is the tendency to plant too many and to allow them to give character to the place. About summer resorts, for example, Poplars and willows are used much too freely. They give the place a look of cheapness. They are planted in such places because they grow rapidly and thrive in unfavorable conditions; but it is better to use them for temporary effects, allowing better trees, that are planted with them, gradually to take their places. The legitimate use of Poplars in ornamental grounds is the production of minor or secondary effects. As a rule, they are less adapted to isolated planting as specimen trees than to use in composition,—as parts of general groups of trees, where their characters will serve to break the monotony of heavier foliage. The Poplars are gay trees, as a rule, especially those, like the Aspens, which have a trembling foliage. Their leaves are bright and the tops thin. A few of them in judicious positions give a place a sprightly air. This is particularly true of the common Aspen, or *Populus tremuloides,* of our woods (Figs. 1906, 1916). Its light dancing foliage and silver-gray limbs are always cheering and its autumn color is one of the purest golden yellows of our landscapes. It is well to have a tree of it standing in front of a group of maples or evergreens. Its whole attitude is then one of familiarity.

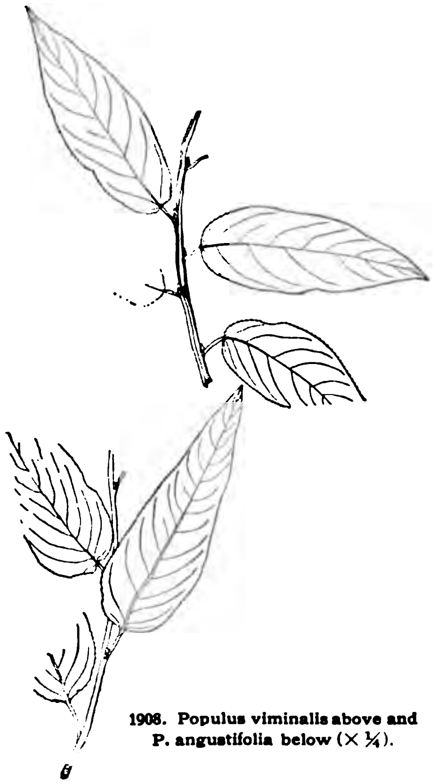
The Cottonwood is perhaps the best of all our Poplars as a single specimen. It makes a noble tree, spreading its gray branches far and wide. But like the Aspen, it is cheerful and restive. One is not moved to lie under it, as he is under a maple or an oak. Its leaves rustle with the lightest movement of air. The ripple of its foliage recalls the play of wavelets on a pebbly shore. The day is never so dark but the Cottonwood reflects a flood of light.

Some of the forms of the black Poplar of Europe are especially satisfactory for the production of lively effects in planting. Of these, none is better than the form known to nurserymen as *Populus elegans.* It has a most pleasing light and tremulous foliage, the effect of which is heightened by a twiggy character of growth and a reddish cast to the leaf-stalks and young shoots. It is an elegant tree, and well adapted to planting in front of heavier foliage in the most conspicuous part of the grounds.

Some of the silver- or white-leaved Poplars produce the most striking contrasts of foliage, especially if set near darker trees. Bolles' Poplar (*Populus Bolleana* of the nurseries) is one of the best of these trees. Its habit is something like that of the Lombardy. The upper surface of the deeply lobed leaves is dark dull green, while the under surface is almost snowy white. Such emphatic trees as this should generally be partially obscured, by planting them amongst other trees so that they appear to mix with the other foliage, or else they should be seen at some distance. Other varieties of the common white Poplar or Abele are occasionally useful, although most of them sprout badly and may become a nuisance. The Lombardy Poplar is probably



1907. A good clump of Lombardy Poplar.



1908. Populus viminalis above and P. angustifolia below (× ¼).

the most striking and distinct tree that is suited to planting in the North. As single specimens scattered here and there in mixed plantings, or when seen over or behind buildings, it may be most picturesque and satisfactory; but the tendency is to plant it too freely. Fig. 1907. The very fact that it is emphatic is the reason why it should be planted sparingly when artistic effects are desired. The catkins, particularly the staminate ones, are usually attractive, as they appear in early spring; but they are of short duration. In the following account, the species are distinguished by characters of foliage and habit, as these are the features chiefly known to horticulturists. The following sketch includes all the Poplars known to be offered by American nurserymen. Some of the Japanese and Siberian forms, however, are in need of careful study. One of the forms known as "Japanese Poplar" may be referable to *P. suaveolens*, Fisch., a species which is united with *P. balsamifera* by some authors. *P. suaveolens* is native to Amurland and Japan. For literature, see Wesmael, DC. Prodr. 16, pt. 2, pp. 323–331; Sargent, Silva of North America, vol. 9 (quoted below as S.S.); Bailey, Bull. 68, Cornell Exp. Sta., from which the following account of the cultivated species is adapted.

INDEX.

acuminata, 2.
alba, 12.
angustifolia, 2.
argentea, 12.
Atheniensis, 9.
balsamifera, 1, 3, 6.
Bereolensis, 6.
betulifolia, 7.
Bolleana, 12.
Canadensis, 5.
candicans, 3.
canescens, 7, 12.
Carolina, 5.
Caroliniana, 5.
Carolinensis, 5.
Oertinensis, 6.
crispa, 1.
deltoides, 5.
dilatata, 7.
Dudleyi, 1.
elegans, 7.
fastigiata, 7.
Græca, 9, 10.
grandidentata, 10.
heterophylla, 10.
Hudsonica, 7.
intermedia, 3.
Italica, 7.
latifolia, 3.
laurifolia, 3, 6.
Lindleyana, 1.
macrophylla, 3.
monilifera, 5.
nigra, 7, 10.
nivea, 12.
Nolestii, 3.
Ontariensis, 3.
Pannonica, 7.
Petrovski, 6.
Polonica, 7.
pyramidalis 1, 7.
pyramidata, 7.
rotundifolia, 11.
salicifolia, 1.
Sibirica, 3.
Sieboldi, 11.
Simonii, 4.
tremula, 8.
tremuloides, 9.
viminalis, 1.
Wobsky, 3.

A. *Terminal buds large and long, glutinous-sticky and with a balsamic odor.*—BALSAM POPLARS.

B. *Petioles terete or channelled (not flattened).*

C. *Branchlets sharply angled.*

1. **viminàlis**, Lodd. (*P. Lindleyàna*, Booth. *P. salicifòlia, críspa, Dúdleyi, pyramidàlis suavèolens*, Hort. *P. balsamífera*, var. *viminàlis*, Loud.). Fig. 1908. Small or medium-sized tree, of slender growth and with a somewhat weeping habit when old: lvs. broad-lanceolate, willow-like, finely serrate, often crinkled on the margin. Asia.—This is very like the native *Populus angustifolia*, which it represents in Europe, but is readily distinguished by its angled or furrowed stems, and less tapering and crisped leaves which are conspicuously finely reticulated and whitened beneath. The color of its foliage is grayish green, and in this respect it affords a contrast to the native species. *P. angustifolia* seems to be rather the better tree of the two, although the *viminalis* has a more striking appearance.

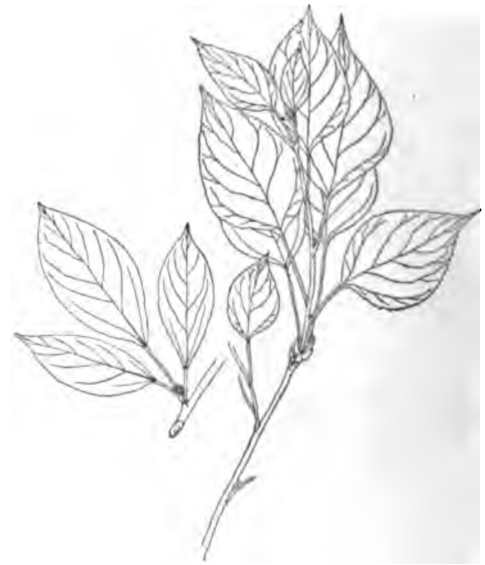
CC. *Branchlets terete (or sometimes grooved on strong growths).*

D. *Leaves long and narrow.*

2. **angustifòlia**, James. Fig. 1908. Small pyramidal or conical tree (reaching 60 ft. in the wild), with slender twigs and small buds, and soft clear green foliage: lvs. small for the genus, lanceolate or ovate-lanceolate, short-stalked, green on both surfaces, finely and evenly serrate: catkins short, densely flowered: ovary somewhat 2-lobed. Interior region from Assiniboia to Nebraska and Arizona, and westward. S.S. 9:492.—Common street tree in parts of the West, and sometimes planted in the East for ornament.—A related species of similar ranges is *P. acuminata*, Rydberg, differing in having long-petioled, rhomboid-lanceolate, acuminate lvs., which are serrate only at the middle. It will probably appear in cultivation.

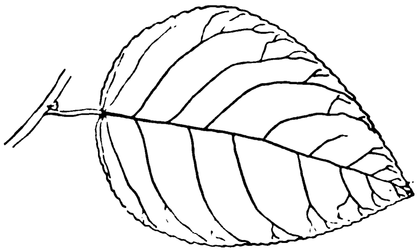
DD. *Lvs. mostly broad-lanceolate to ovate or rounded.*

3. **balsamifera**, Linn. BALSAM POPLAR. TACMAHAC. Fig. 1909. Tall upright tree, with a narrow straight top: lvs. thick and firm, erect, whitened beneath, usually smaller than in most other Poplars of this group, in shape ovate-lanceolate or oval, tapering towards the top and sometimes at the base, finely and obtusely toothed, dark green above. but whitish or rusty beneath: catkins drooping, slender but rather densely fld., appearing in very early spring. Newfoundland to British Columbia, and southward into the northern tier of states; Asia.



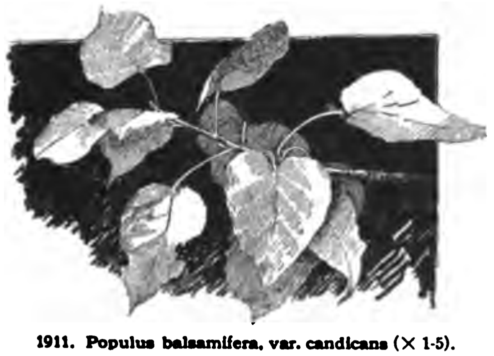
1909. Populus balsamifera (× ⅓).

S.S. 9:490.—The native form is occasionally seen about farm buildings and roadsides, where it makes a durable and interesting tree; but it is rather too stiff for the pleasantest effects and too narrow for the best shade. The dull whiteness of the under side of the leaves affords a pleasant variety and contrast in its foliage, and the fragrance of the resinous buds in spring is agreeable to most persons. It is a desirable tree for occasional planting, but, like the Lombardy, it generally appears to best advantage when placed amongst other trees. It is a hardier tree than the Lombardy, and does not run quickly to such extravagant heights. In cultivation from Russian sources, it is known as Nos. 16 and 26 Voronesh and 32 Riga. The Balsam Poplar is probably the most variable of Poplars. In cultivation in this country it is represented by at least three well-marked botanical varieties, differing from the species and from each other in the habit of growth, shape and color of leaves and character of twigs.

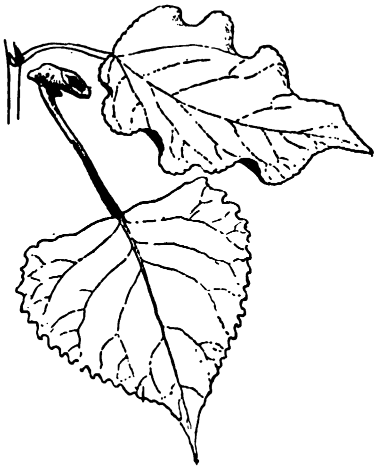

1910. Populus balsamifera, var. latifolia (× ⅓).

Var. **intermèdia**, Loudon (*P. laurifòlia* of American horticulturists, not of botanists. *P. Sibírica pyramidàlis*, Hort.). A comparatively slow-growing tree of close, upright habit: lvs. very thick and hard, finely serrate, oval in outline, and prominently whitened beneath, commonly rather small for this group: twigs hard and cylindrical. N. Asia.—It is considered to be a valuable tree for hot and dry interior climates; and it also has distinct merit for ornamental planting. It eventually becomes a large tree. The *Populus laurifolia* and *P. Sibirica pyramidalis* of American nurserymen are, apparently, only minor variations of this type. These trees are amongst the recent introductions of Russian Poplars.

Var. **latifòlia**, Loudon (*P. Nolèstii* and *P. Wòbsky*, Hort.). Fig. 1910. Includes forms with ovate or cordate-ovate rather blunt-pointed leaves, cylindrical twigs (or slightly ridged on strong shoots) and the general habit of the Balsam Poplar. Asia.—The lvs. are usually large and thick, shining green above and dull white beneath, in shape and texture somewhat like the next variety. The Nolestii Poplar is now sold by eastern nurserymen as an ornamental tree. Its strong habit and dark foliage adapt it admirably to planting near the rear borders of grounds. The Wobsky Poplar is one of the recent Russian introductions, with somewhat the habit of a cherry tree, and is much prized in the Northwest. The Rasumovskoe Poplar appears to be of the same type.


1911. Populus balsamifera, var. candicans (× 1-5).

Var. **cándicans**, Gray (*P. cándicans*, Ait. *P. Ontariénsis* and *P. macrophýlla*, Hort.). BALM OF GILEAD. Fig. 1911. Strong-growing spreading native tree, frequently planted, and esteemed for its vigor and hardiness and the resinous fragrance of its large buds in spring-time: lvs. broad and heart-shaped, green above and veiny and rusty-white beneath, the leaf-stalk usually hairy and somewhat flattened. New Brunswick to N. J. and W. to Minn. S.S. 9:491. Gn. 29, pp. 125, 126.—It is very different from the Balsam Poplar in method of growth, as it has none of the pyramidal or spire-like tendency of that species, but usually makes a broad and irregularly spreading top. While the tree is common in cult., it is rare wild. In the early days, however, it was found in very large trees in Michigan and other western states, and was used for sawing timber; and small isolated natural groves of it are still to be seen. The Balm of Gilead makes a good street tree, and is perhaps the best of the Poplars for shade. Well-grown trees have the darkest and richest foliage of any common Poplar, and this character makes the tree valuable in heavy groups about the borders of a place. The top is liable to become open and broken with age, however, and the tree often sprouts profusely. It is not well adapted to smoky and dusty locations, as it soon becomes grimy. Probably a good species.


1912. Populus deltoides below, P. laurifolia above (× ¼).

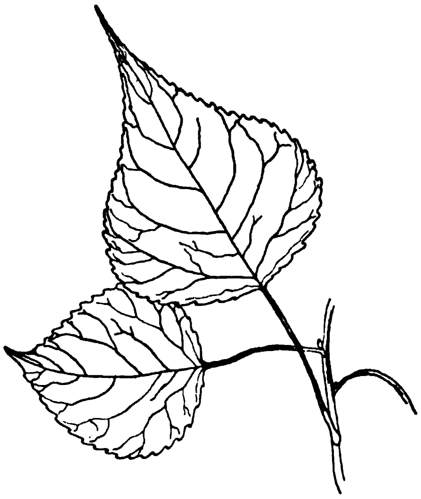
4. **Simonii**, Carr. A strong, strict tree with lvs. differing from those of the Balm of Gilead in having a rounded or tapering base and much finer teeth, but otherwise they are much alike. The shoots are reddish brown and spotted, and deeply grooved. China.—Int. into France about 1861 by M. E. Simon, and somewhat planted in this country. Some authors consider this to be only a form of *P. balsamifera*, and if the Balm of Gilead is to be regarded as a form of that species, perhaps this should be. For horticultural purposes, however, it seems to be distinct. It has been planted as far north as Manitoba with entire success. It is a very rapid grower. Useful where quick-growing wind-breaks are desired.

BB. *Petioles usually distinctly flattened, so that the leaves turn easily in the wind.*

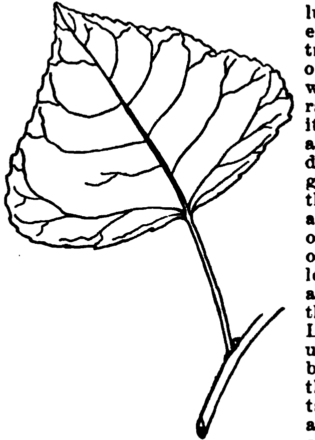
C. *Leaves large, for the most part as long as, or longer than, broad.*

5. **deltoides**, Marsh. (*P. monilífera*, Ait. *P. Canadénsis*, Moench). COTTONWOOD. Fig. 1912. Becoming a large, much-branched picturesque tree, with deeply furrowed gray-brown bark: lvs. large, triangular-ovate, mostly truncate or nearly straight on the base, abruptly acuminate, coarsely crenate-dentate but the margin plane or flat, the petiole long, much flattened near

the blade and commonly with 2 or 3 glands at the top, the stipules small and falling early: catkins long and loosely flowered: fruit an ovoid acute capsule. Generally distributed from Quebec to the Rocky Mts. and south to Fla., mostly in moist lands or along the mountains. S.S. 9:494, 495.—Variable. Some of the forms are fairly distinct in foliage and aspect, and they appear to be associated with particular horticultural names in the nurseries. Some of the most ornamental specimens of Cottonwood are those with reddish leaf-stalks and midribs. Taking all things into consideration, the Cottonwood is probably the best of the Poplars for general ornamental planting. It grows rapidly and in almost every soil, and yet it possesses elements of strength and durability which most of the Poplars lack. Its foliage is always bright and glossy, and the constant movement of the broad rich green leaves gives it an air of cheeriness which few trees possess. The tree has been much used upon the prairies and in nearly all western towns, much too abundantly for good landscape effects. The rapid growth of the tree gives a feeling of luxuriance to plantations even when most other trees appear to be weak or starved. The Cottonwood thrives best on rather low lands, and yet it is generally an admirable tree upon high and dry areas. There is a golden-leaved form of the Cottonwood known as variety *Van Geertii* or var. *aurea*. This is one of the best of yellow-leaved trees, and generally holds its color throughout the season. Like all trees of this unusual character, it should be used cautiously, and the best effects are obtained when it is planted against a group of trees so as to appear as if naturally projecting from the other foliage.



1913. Populus deltoides, var. Carolinensis (× ¼).



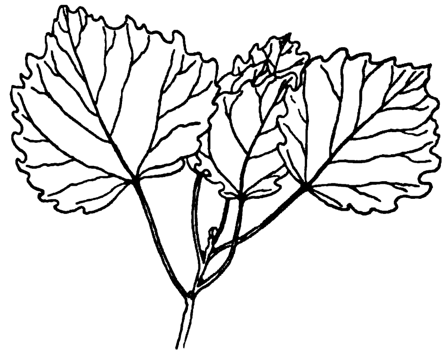
1914. Populus nigra, var. Italica—Lombardy Poplar (× ⅛).

Var. **Carolinénsis** (*P. Carolinénsis*, Willd. *P. Carolina* and *Caroliniàna*, Hort.). CAROLINA POPLAR. Fig. 1913. A very distinct tree in habit of growth, making a straight upright or pyramidal head: lvs. usually less distinctly deltoid and more gradually taper-pointed than in *P. deltoides*. Native.—The Carolina Poplar is much planted, and nurserymen consider it to be distinct from the Cottonwood. It differs in strict, straight appearance, and it is a most vigorous grower. It is much planted in Europe, where it is known as the Swiss Poplar. Its botanical position needs to be investigated.

6. **laurifòlia**, Ledeb. (*P. balsamifera*, var. *laurifòlia*, Wesm. *P. Certinénsis*, *P. Petróvski*, *P. Bereolénsis*, Hort.). CERTINENSIS POPLAR. Fig. 1912. A very rapid-growing and hardy tree, with a strong central leader and a very heavy, dense foliage. Differs from *P. deltoides* as follows: lvs. broad-ovate in outline, with a rounded or tapering base and rather short point at the apex; the margin rather closely-toothed, wavy; leaf-stalk comparatively short, only moderately flattened, glandless at the top; stipules present and conspicuous: bud long: shoots slightly hairy. Siberia.—The foliage on the old wood or upon slow-growing shoots is very unlike that upon the vigorous branches, and is almost identical with that of the Balsam Poplar, being broadly oval, with finely serrate margins, and whitish beneath. The twigs, also, are cylindrical. But the strong shoots are strongly angled or grooved and the foliage is much like that of the native Cottonwood but darker; and the growth is more close and erect. The sketch in Fig. 1912 distinguishes the leaves. The Certinensis Poplar is a more rugged tree than the Cottonwood, with healthier foliage in the presence of leaf-rust, and its wood is said to be valuable. It is now much planted in the Northwest, and deserves to be widely distributed. Its effect in the landscape is considerably unlike that of the Cottonwood. Its leaves stand out more horizontally, while those of the Cottonwood hang loosely and often vertically and therefore give the tree-top a heavier look. The terminal spray of the two is particularly distinguishable in this regard. The leaves of Certinensis upon the strong, erect shoots stand almost at right angles to the shoot, and, at some distance, therefore, present only their ruffled edges to the eye, producing a unique and picturesque effect.

CC. *Leaves relatively small, mostly as broad as, or broader than, long.*

7. **nigra**, Linn. BLACK POPLAR. Tree of medium to large size, with leaves somewhat resembling those of the Cottonwood, but generally smaller and much less deeply toothed, shorter in proportion to their width and often with a tapering or rounded base; leaf-stalk much flattened, so that the foliage moves freely in the wind. Eu., Siberia. — The tree usually has a pyramidal habit of growth and a dark cast to the foliage. It is a less lustrous tree than the Cottonwood and grows more slowly. Specimens were found escaped along the Hudson by Michaux, who thought it an American species and published it early in the century as *Populus Hudsonica*. Pursh, in 1814, published it again as the "birch-leaved Poplar," *Populus betulifolia*, from trees found near Lake Ontario. Although it was found half wild in New York about a century ago, it does not appear to have increased itself in America, for it is



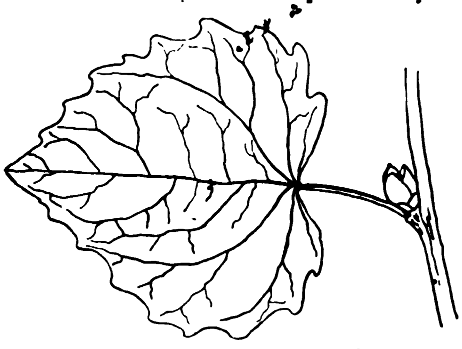
1915. Populus Tremula (× ⅓).

rarely seen, even in cultivated grounds. It is sometimes spontaneous in the East. The tree known in the West as *Populus betulifolia* is only a robust form of the European *P. nigra*. Variable in cult. and grown in European collections under a variety of names. With the exception of var. *Italica*, these forms are little known in this country.

1916. Populus tremuloides (× ⅓).

Var. **élegans**, Bailey (*P. elegans* of nurserymen), is a tree of pronounced strict or pyramidal habit, but considerably broader than the Lombardy Poplar: foliage small and light-colored and very versatile in a breeze, with a handsome reddish tint to the leaf-stalks and young shoots. It is worth growing in every well-kept place, especially if placed against a planting of heavier foliage. *Populus canescens* of some American nurserymen is very like this, although it has less color and brightness.

Var. **Itálica**, Du Roi (var. *pyramidàlis*, Spach. *P. Itálica*, Moench. *P. dilatàta*, Ait. *P. fastigiàta*, Desf. *P. pyramidàlis*, Rozier. *P. pyramidàta*, *P. Pannónica*, *P. Polònica*, Hort.). LOMBARDY OR ITALIAN POPLAR. Figs. 1907, 1914. Differs from the typical Black Poplar (*P. nigra*) in its tall, narrow growth, glabrous young shoots, a confirmed habit of suckering from the root and generally a more tapering base to the leaves. It is one of the characteristic trees of parts of Italy, and it is from one of the Italian provinces, Lombardy, that its common name is derived. The tree is probably native in Asia, however. With age, the Lombardy Poplar becomes one of the most striking and picturesque of trees, particularly when some of the sprouts are allowed to grow about the old stock, as in Fig. 1907. In the northernmost states it is not long-lived.



1917. Populus grandidentata (× ¼).

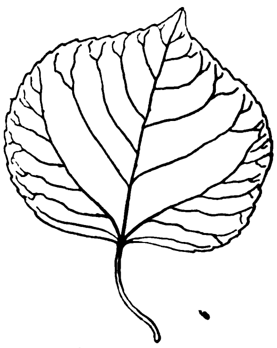
AA. *Terminal buds relatively small, not glutinous, often pubescent.* ASPENS and WHITE POPLARS.

B. *Mature lvs. usually green, greenish or brown beneath.*

8. **trémula**, Linn. EUROPEAN ASPEN. Fig. 1915. Open headed, light-leaved tree, becoming 50–60 ft. tall: lvs. small and thin, round-oval, more or less whitened beneath when young, bordered with deep and rounded incurved teeth; the leaf-stalks long, slender and flattened, giving a restless motion to the foliage: leaf-buds small. Widely distributed in Europe and Asia, in this country known chiefly in its weeping form (var. *pendula*).—The weeping form of the European Aspen is perhaps the best weeping tree amongst the Poplars. The spray is light, airy and fountain-like, quite unlike the more common weeping forms of our native *Populus grandidentata*, which present a stiff, angular form, a combination that is rarely pleasing. A characteristic feature of this tree is the profusion of its very long catkins that appear in earliest spring, even before our native Poplars are in bloom. The staminate or male catkins are particularly pleasing, and planters should select that sex, if possible.

9. **tremuloides**, Michx. (*P. Atheniénsis* and *Græca*, Hort.). AMERICAN ASPEN. Figs. 1906, 1916. Very like *P. tremula*, but the lvs. are usually less circular and more abruptly acuminate, the margins are small-crenate rather than deeply toothed, and the lvs. are green on the under side. Generally distributed in North America north of Pennsylvania and Kentucky, and extending to Mexico in the mountains. S.S. 9:487.—One of the first trees to spring up in clearings. The bark of the young trees is whitish gray, rendering the saplings very conspicuous in a coppice. In woods the tree is said sometimes to reach a height of 100 ft., but it is usually much smaller than this. There appear to be no horticultural varieties.

10. **grandidentàta**, Michx. (*P. Græca péndula*, *P. nigra péndula* and *Parasol de St. Julien* of nurserymen). LARGE-TOOTHED ASPEN. Fig. 1917. Tall, straight tree, becoming 75 ft. high, known in cultivation in various weeping forms. Distinguished from *P. tremula* by much larger and thicker lvs., which are bluish or rusty white beneath, more ovate in outline, with larger and more spreading teeth, stouter leaf-stalks and larger leaf-buds. Nova Scotia to Minn. and Tenn. S. S. 9:488.—In its normal or erect form it is rarely cultivated, but the weeping kinds, under a variety of names, are frequently seen. Most, and perhaps all, of these varieties originated in Europe, where the tree, like the Cottonwood and the common Aspen, were early introduced. The habit of the tree is too stiff and the foliage rather too heavy to make the best weeping subjects, however. One of the best of these weeping forms is that known as Parasol de St. Julien. The winter twigs of the weeping varieties have a characteristic weak or zigzag growth.—*P. heterophylla*, Linn., a tall tree of the eastern U. S., may be in cult., although it does not appear in trade lists. It has cordate-ovate, obtuse, crenate lvs., with terete petioles, the young parts and the lvs. white-tomentose. It is mostly an inhabitant of swamps.



1918. Populus Sieboldii (× ¼).

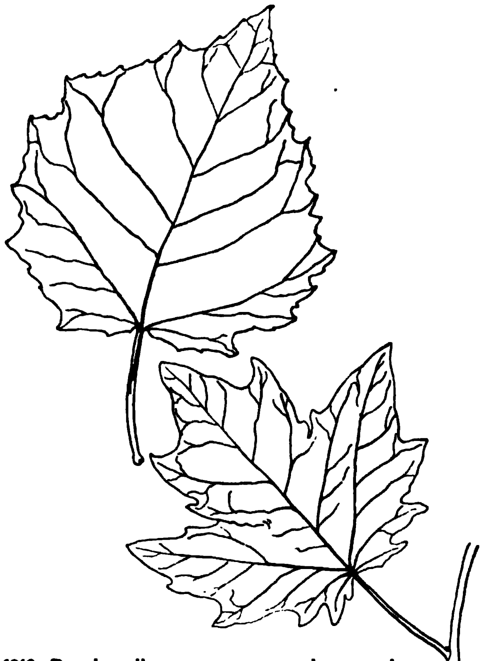
11. **Sièboldii**, Miq. (*P. rotundifòlia*, Hort.) Fig. 1918. Tree, 20-[illegible] ft., of spreading habit, with rather dark and heavy foliage: lvs. large, round-ovate, with a short triangular subacute apex, nearly or quite truncate at the base, dentate-serrate, with shallow incurved teeth, more or less whitened beneath. Japan.—Hardy in western New York.

BB. *Mature lvs. usually white tomentose beneath, at least in the cultivated forms.*

12. **álba**, Linn. WHITE POPLAR. ABELE. Large, much-branched tree, with whitish bark on the young branches: lvs. much like those of *Populus grandidentata*, but smaller, usually thicker and more angular, the under surface—especially early in the season—woolly white. Eu. and Asia.—The typical form of *Populus alba* is less

grown here than the varieties with lobed and very white-bottomed (and sometimes variegated) leaves.

Var. **nívea**, Wesm. (*P. nivea*, Willd. *P. argéntea*, Hort.). This is the commonest form of white Poplar in this country. It is known by the snow-white under surfaces of its foliage and the 3- or 5-lobed maple-like leaves. It is far too frequent about old yards, where its inveterate brood of suckers make it a perpetual nuisance. It is sometimes called Silver Maple, from the resemblance of its foliage to that of the maple. As a street tree in cities it is particularly offensive, for the cottony covering of the under side of the leaves and of the shoots holds soot and dust, and it looks repulsively dirty. Useful for foliage effects in large plantings.



1919. Populus alba, var. canescens above, and var. Bolleana below (× ⅓).

Var. **canéscens**, Loudon. Fig. 1919. Leaves broad or nearly circular in general outline, prominently notched but not lobed, the under surfaces and the young shoots very gray-woolly. This tree is met with occasionally. Its horticultural value is not greatly different from that of var. *nivea*. By some thought to be a hybrid of *P. alba* and *P. Tremula*.

Var. **Bolleàna**, Lauch. (*P. Bolleana*). BOLLES' POPLAR. Fig. 1919. A very tall, narrow-topped tree, with cottony lvs. rather more deeply lobed than those of the var. *nivea*. The tree was introduced into Europe in 1875 from Turkestan, and it was named for Dr. C. Bolle, an arboriculturist. It bears about the same relation to *Populus alba* that the Lombardy Poplar bears to *Populus nigra*. Its fastigiate habit, combined with the white foliage and shoots, makes it a most emphatic tree, and there is great danger of planting it too freely. Seems to be short-lived.

L. H. B.

PORTO RICO as a Field for Horticulture. Porto Rico (Fig. 1920) is a land of perpetual summer, awaiting only the skill of the experienced grower to blossom into an exotic fruit garden for our eastern states. It is our only bit of tropical soil on the Atlantic side of the continent, and now possesses tariff protection for the fruit-grower and vegetable-gardener which amounts to a handsome profit in itself. As compared with Florida, the climate and the soil are in favor of Porto Rico, while in the matter of transportation, San Juan already has the advantage of most Florida points.

CLIMATE.—Porto Rico is more healthy than most other regions of the same latitude, because it has more hills and mountains, is more breezy, and because of its innumerable streams of pure water.

The seasons are marked by the spring rains beginning about May 1, and the fall rains closing about Nov. 1, although in some parts rain falls every month in the year. In the absence of irrigation, planting depends on these periods. Tobacco and vegetables succeed best when planted in the fall, as the direct sun and pouring rains, liable to come in the summer months, injure them. A sharp range of mountains, from 2,000 to 3,500 ft. high, traverses the length of the island a few miles from the south coast, and all the remainder of the area, except the river bottoms, and a coast fringe of alluvial plain, varying from a mere beach up to five miles in width, is intricate mountain and hill, threaded by countless streams.

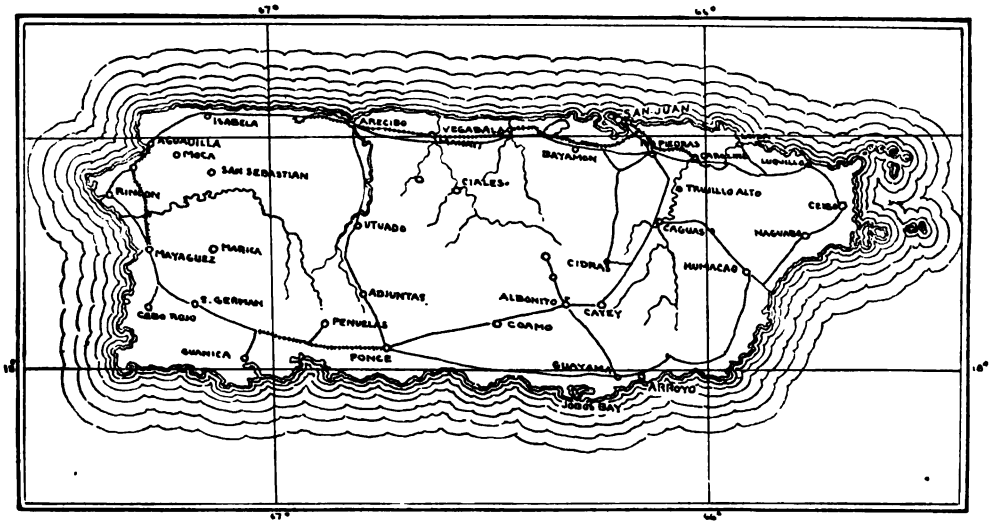
This topography creates great local climatic differences, a cooler and more moist temperature in the interior, with bright, clear weather on the sheltered coasts. At sea-level the mercury rarely falls to 60° in winter nights and in summer days rarely exceeds 95°. The yearly average night temperature is about 70° and that of the day about 85°. The nights are always comfortable for sleeping. Lack of food and medicines and exposure to rains are responsible for most of the illness in Porto Rico.

PRODUCTS.—Coffee, sugar cane, stock-raising, the cultivation of vegetables, and fruit-growing are the leading industries of the island, their relative importance being in the order named. Coffee and tobacco are not, strictly speaking, horticultural products, and yet, as their cultivation is more nearly that of the orchard and garden than that of the field, a few observations about them, of a general character, seem to be in place.

Coffee.—The growing of coffee presents some attractions to the American horticulturist commanding, say, $20,000, or upwards. The climate of the hilly and mountainous interior, where coffee luxuriates, is cooler and more refreshing than that upon the low cane belt bordering the sea. Coffee is a staple. It improves with age and can be transported over a mountainous trail, and hence is sure of a market. The disadvantages are the low value of the product under present market conditions, the considerable cost for machinery if the price for cleaned and assorted coffee is to be obtained, and the fact that coffee is on the free list. A new market will be opened in the United States when the fine aroma of Porto Rican coffee becomes known. Better system in cultivation and a cheaper means of transportation will improve the status of the business, but the writer is convinced that this industry will not advance as will that of the higher-priced, protected products like sugar, tobacco, oranges, pineapples and vegetables.

Tobacco.—The backwardness of the tobacco business seems to be largely due to the fact that it has been chiefly in the hands of the peasant class, lacking the capital and special knowledge to perfect it. The curing, assorting and marketing of tobacco have not been reduced to a fine art as they have in the Vuelta Abaja district of Cuba. There can be no doubt of the fact that there are districts in Porto Rico where climate and soil are admirably adapted to the production of a high-grade leaf. This is proved by the fact that in years of shortage of the tobacco crop in Cuba, Porto Rico tobacco has been extensively exported to Havana, re-cured and re-sorted, and the finer quality sold as Havana leaf. Cayey is the center of the best tobacco section of the island. There are a number of tobacco farms and very many small peasant's patches in this vicinity. Caguas and Comerio, not far distant, are lesser centers of the business. There is a bright future for the experienced, progressive tobacco-grower. Success may be expected with a moderate capital, as returns are quick, the value of an acre's product is large, and the tariff conditions are extremely favorable for the Porto Rican as compared with the Cuban, Sumatran or Mexican grower.

Fruit-Growing in General.—Probably the most inviting field for the horticulturist in Porto Rico is the cultivation of the various tropical and subtropical fruits, particularly the orange and other citrous fruits, and the pineapple. The growth of the trade in tropical fruits from the British West Indies, chiefly Jamaica, without any help from tariff legislation, would show what can be done in Porto Rico under present circumstances. In 1895 these islands shipped us fruits and nuts to the amount of $1,816,751, and in 1899 to the amount of $3,783,488. Costa Rica in the same interval increased her trade with us in these products from $362,945 to $972,098, and Santo Domingo from $16,684 to $152,535. The increase in the value of oranges shipped by the British West Indies, chiefly Jamaica, was from $173,396 in 1895 to $553,751 in 1899, and this in spite of the increase of the adverse tariff, raised to a cent a pound in 1897. It is a significant fact that this great business in tropical fruits, scarcely more than begun twenty years ago, is conducted by Americans and under stable British rule rather than in the Spanish Antilles.



1920. Outline map of the island of Porto Rico.

Porto Rico produces some oranges as fine as any grown in Jamaica, but not in the same quantity, as the Spanish authorities have not been as assiduous as the British in fostering desirable fruits in their colonies. Then, too, a regular service of well-ventilated banana steamers was established in Jamaica when the great Florida freeze of 1894–5 gave her an opportunity in the orange business. The conditions are now all favorable in Porto Rico for the growth of citrous fruits in their perfection. Repeated destructive freezes in Florida have ruined the hopes, once entertained, for that state as a sure orange-producing section. Floridians are removing to Porto Rico, and this movement will increase now that Porto Rico is sure of a just, progressive government and a stable market.

Two lines of steamers furnish excellent weekly communications in both directions, between San Juan and New York. Better transportation facilities between the seaports and the interior are required before the fruit industry can prosper there. The highways building and to be built and the extensive system of trolley railroads now projected, will supply this missing condition as fast as the fruit can be produced.

Oranges thrive in all sections of Porto Rico, a shelter from the prevailing winds and a well-drained soil being the favoring conditions. They are most plentiful in the Mayaguez district. Several Americans are engaged in this business near Bayamon, and also in the vicinity of Toa Alta, Fajardo, Humacao, Jobos Bay, Panuelas, and in other sections with encouraging prospects, and a considerable acreage will be planted in 1901.

Pineapples.—Porto Rico is justly famed for the excellence and size of its pineapples. Webber writes, in "Pineapple Industry in the United States," published in the Yearbook of the Department of Agriculture for 1895, that "The best pineapple regions in the world have a mean temperature of from 75 to 80°," which is that of Porto Rico. Fig. 1923. The varieties grown are the Pan de Azucar, Sugar Loaf, a very sweet yellow-fleshed variety, and the Cabezona, Porto Rico, the large and vigorous sort which originated near Lajaz. Grown upon virgin soil on the rich but stony hillsides of its native habitat, the last pineapple is a revelation to the eye and delight to the palate.

Some difficulty has been experienced in carrying pineapples from Porto Rico to New York. This is due to rough handling, carting over infamous roads, poor packing and inadequate ventilation on ship. More carefully handled shipments made during the past year turned out well.

Bananas and Plantains.—This noble race of tropical fruits grows upon the island in great variety and luxuriance. Among the forms seen are the Apple, the Fig, the Date, the large red, and our common yellow banana known as the Aspinwall or Johnson, as well as the large plantains, which are chiefly used for cooking as vegetables. There is no strong probability of a large export trade in bananas being developed in Porto Rico in the near future, as they are admitted to the United States free of duty. The best banana lands must be comparatively close to the coast, and such lands are likely to pay better in sugar cane. Some of the rarer sweet varieties may be handled to advantage, particularly the Fig and Apple varieties. In connection with coffee-growing, if the grower is close to a good market, the sale of bananas might be made the source of a good revenue.

The Cocoanut Palm.—This graceful and valuable tree grows abundantly along the Porto Rican seacoast. The ripe nuts are exported to a limited extent. Cocoanut oil, cocoanut butter and desiccated cocoanut are valuable products easily prepared. From the fiber paper brushes and mattresses are made. The wood, after hardening, makes excellent canes. From the half-ripened fruit the "coco de agua," or water-cocoanut, a clear drink, is obtained, which taken direct from the shell is a healthful and refreshing beverage.

Other Fruits.—There are numerous tropical fruits of greater or less value, some of which will ultimately become articles of wide consumption by the fruit-lovers of the North. Mangoes, pomegranates, aguacate or alligator pears, are already sold in the fruit stores of our large cities. The luscious "anones" (*Anona squamosa* and *A. muricata*), the pink-and-white-fleshed star apple, and the large "corazones" (*Anona reticulata*) are delicious fruits, especially with a touch of lime or lemon juice to give them life. Somewhat similar in taste, but smaller, is the "nispero" or sapodillo, which, with its brown skin, resembles a rusty colored pear. The "lechoza," or tropical pawpaw, is a valuable fruit. The tree has a straight trunk, surmounted by a crown of enormous spreading leaves, under which the good-sized fruit is borne in a cluster.

The "guayaba" or guava, which grows abundantly throughout the island, is used for making jelly and paste. The business of jelly-making and of preserving, canning and drying fruits will be developed. The "naranja," or sour orange, is particularly valuable for marmalade.

1921. Porto Rican plantation or farm.

Preserved ginger, so largely imported into the United States, could be profitably prepared, as the root is now raised and exported.

Vegetables.—That vegetables can be grown in Porto Rico in the winter or "dry season" and sold in New York at remunerative prices was demonstrated last season. The writer had charge of an experimental garden in which a third of an acre each was devoted to growing tomatoes and eggplants. Although the seed was not sown until December, three months too late for a full season, satisfactory shipments were made in April and May which brought the full market price. There are aphids, caterpillars and mites to be fought, so that the grower must be prepared with insecticides.

The soils of Porto Rico average richer than those of our Atlantic seaboard, but for the production of vegetables of high quality, intensive culture is required. The stimulating character of the climate is such that there is a tendency for vegetables to branch unduly, so that unless high fertilization, frequent cultivation and severe pruning are employed the quality and size of the fruit soon deteriorates and is worthless for shipments. The heavy rainfalls of spring and fall interfere with the setting of fruit, so that the season for marketing vegetables in the north must be from about December 15 to May 15. Absolute immunity from frost or even a check from cool nights is the great vantage ground for winter gardening on the island. Vegetables must be shielded from the drying effects of the stiff northeast trade-winds, and it is probable that a shade will be required for success in melon and cucumber culture. A skilful gardener, acquainted with the climate, may expect to produce $500 to $1,000 worth of tomatoes or eggplants per acre. Fig. 1924.

At the present time San Juan is the only port with good shipping facilities for perishable products such as vegetables. Beans, melons of every kind, cucumbers, peppers, okra, sweet potatoes, peanuts, etc., thrive in this genial clime. The more hardy vegetables, such as Irish potatoes, cabbage, lettuce, radishes, beets, and peas succeed in the fall and winter, especially in the hill country.

Native Vegetables.—Besides the several varieties of "batatas," or sweet potatoes, largely used in Porto Rico, there are several kinds of the larger tropical yams. The dark green foliage of these plants has a rich beauty, trailing from their pole supports. The roots of the broad-leaved "yantias," or colocasias, popularly called elephant's ears, are also extensively used by the peones for food. The cassava, both the sweet and bitter varieties, flourish in Porto Rico. The former is a valuable food for both man and beast. The roots are excellent baked. There is no better source for producing starch than cassava, which is now manufactured in a crude way in some sections of the island and exported to a limited extent.

Other Possible Resources.—The cacao, or cocoa tree, is grown in Porto Rico and the product manufactured and exported, but only to a limited extent. Our imports of this product from the British West Indies have increased from $1,262,191 in 1895 to $2,107,150 in 1899, which indicates the possibilities of expanding the trade. Another possibility of profit for the island lies in utilizing certain steep, dry chalk ridges, now of little value, for the cultivation of the "maguey," the agave from which the sisal is obtained. The importation of this fiber from the British West Indies has increased from $2,734,909 to $4,771,989. Arnatto or "achote" finds a congenial home in Porto Rico, and should be made to yield a profit. The castor oil plant bears abundantly, and its bean is exported. The bean of a valuable leguminous plant, "hedionda," is used by the natives as a substitute for coffee and also to mix with it. This plant seems to have a secondary value in improving the soil as a gatherer of nitrogen. The camphor, the rubber, the nutmeg, allspice or pimento, and other spice-producing trees, and the vanilla may all be grown perhaps with profit on the island.

ECONOMIC CONSIDERATIONS.—Under the Porto Rican law of May 1, 1900, all merchandise coming into the United States from Porto Rico, and coming into Porto Rico from the United States, shall pay 15 per cent of the duties required to be paid upon like articles imported from foreign countries. All the duties mentioned above are to cease March 1, 1902, or at an earlier date by certain action of the Legislature of Porto Rico. The present duties are so insignificant compared with those of other countries and their tenure so brief and uncertain that for our purpose of a business forecast, we may properly assume free trade as established.

The grower of oranges and other citrous fruits has the advantage of one cent per pound over the foreign grower, which, on a crop of 300 boxes per acre, would amount to about $200. On pineapples crated, the duty is 7 cents per cubic ft., or 35 cents for a standard crate, or a gain of at least $50 per acre for a fair crop. On pineapples in bulk the duty is $7 per 1,000, a gain of $30 to $50 an acre.

The duty on vegetables is 25 per cent on their listed valuation. This is an advantage of from $40 to $75 an acre on tomatoes or eggplants.

1922. Characteristic rural scene in Porto Rico.

Foreign tobacco wrappers pay, if unstemmed, $1.85 per pound, and if stemmed, $2.50 per pound, and fillers 35 cents if unstemmed and 50 cents if stemmed.

Palms, orchids, bulbs and all greenhouse plants pay 25 per cent, seeds 30 per cent, dried fruits, desiccated cocoanut, etc., pay 2 cents per pound; manufactured chocolate from 15 per cent to 50 per cent, according to quality; castor oil beans and other oil seeds 25 per cent; castor oil 35 cents per gallon; bay rum and bay water $1.50 per gallon. Starch pays 1½ cents per pound, rice 2 cents per pound; while sugar pays $\frac{95}{100}$ cents per pound if not over No. 16 Dutch standard in color, and $1\frac{95}{100}$ cents per pound if above that standard.

Labor.—Gen. Roy Stone in an article, "Porto Rico and Its Future," in Munsey's magazine for August, 1900, testifies from large experience to the effectiveness of the Porto Rican native laborers, and the writer considers them material for excellent gardeners, possessing as much quickness and natural intelligence as the better class of Hindoos he has employed for like labor in Jamaica.

There are good opportunities in Porto Rico awaiting the capitalist and the horticulturist, for it is a field in which every dollar intelligently invested in tropical production is almost sure of a rich return. The island is abjectly poor to-day. It has but $3,600,000 for a population of nearly a million, and all of this but $600,000 is in the hands of the merchants and bankers, who will do nothing to develop the country.

AUTHORITIES ON PORTO RICO.—Valuable works bearing on our subject are: A bulletin, "Agriculture in Porto Rico," of the Department of Agriculture by Gen. Roy Stone, reprinted from the year book of 1898; a book on Cuba and Porto Rico by Mr. Robert T. Hill, and the full and informing volume of Mr. William Dinwiddie, "Puerto Rico, its Conditions and Possibilities." For statistics, see Bull. 13, section of Foreign Markets, U. S. Dept. Agric. on Trade of Puerto Rico, 84 pp., by Frank H. Hitchcock, 1898.

F. M. PENNOCK.

GENERAL NOTES ON PORTO RICO.—The following notes are selected from the "Report on the Census of Porto Rico, 1899," compiled under the direction of Lt.-Col. J. P. Sanger and published by the War Department.

Most of the area of Porto Rico is held as farms, and a large portion, more than one-fifth, is under cultivation. The forested areas are small and are almost entirely confined to the higher parts of the mountains. The largest of these tracts is on El Yunque, in the Sierra Luquilla. Here are found small tracts of primeval forest, composed of large trees of a variety of species, several of which are of great value, such as Spanish cedar, ebony and sandalwood, besides many others as yet unknown to American markets. Timber is, however, very scarce, and most of that used in building is imported.

Lying in the tropics, the island is within the region of the southwest trades, which blow with great regularity. The annual temperature at San Juan, on the north coast, ranges in different years from 78 to 82° F. The mean monthly temperature ranges from 75° in January to 82° in August. The maximum temperature on record is 99°, and the minimum 57°, indicating a very slight range and a uniform climate. The only difference of temperature to be observed throughout the island is due to altitude, the highlands of the interior having a mean annual temperature as low as 72° F. Serious storms occur, and occasional earthquakes, but the latter are not violent, doing but little damage. The annual rainfall at San Juan averages 60 inches, about the same as at New Orleans, and nearly two-thirds of this falls in the summer and autumn. The annual relative humidity at the capital is very high, averaging not far from 80 per cent. The annual rainfall increases eastward from San Juan, until near the northeast corner of the island it exceeds 100 inches. It increases also upon the highlands of the interior, reaching a maximum upon the dividing ridge of nearly 100 inches. The south slope of the island, on the other hand, is much drier, both rainfall and atmospheric moisture being less, so much so that in some regions irrigation is necessary for cultivation of crops.

1923. Pineapple plantation in Porto Rico.

1924. Tomato-growing in Porto Rico. The plants are tied to cords supported on stakes.

Owing to the fact that Porto Rico has for centuries maintained a dense population almost entirely supported by agriculture, a large portion of its surface is under cultivation, and only a trifling proportion remains in its natural condition. Hence little of its vegetation is indigenous. The native fauna of the island is, owing to the same cause, very limited. There are no large mammals except such as are domesticated. It is said that there are no noxious reptiles and few insect pests.

Of the total area of Porto Rico—3,606 square miles—2,743 square miles were included within farms. This is 76 per cent, or more than three-fourths of the area of the island. The area under cultivation was 747 square miles, or not less than 21 per cent of the entire area of the island. These figures are in strong contrast with those for Cuba, of which 29.9 per cent only were included within farms and only 3 per cent of the area of the island was under cultivation. They approach more nearly the condition of things in the United States, where in 1890 16 per cent was under cultivation. Yet, considering the density of the rural population, which is far beyond that of any part of the United States, the proportion of cultivated land is small. To illustrate this, consider the case of Illinois, in which the number of rural inhabitants to a square mile was in 1890 but 42, or less than one-fifth as great as in Porto Rico, while more than seven-tenths of its area was under cultivation.

The total number of farms in Porto Rico was 39,021; the total area was 1,757,774 *cuerdas* (practically equivalent to an acre); the average farm had an area of but 45 *cuerdas*, or acres; the cultivated land comprised 477,987 *cuerdas*, an average to a farm of only 12 *cuerdas*. In the United States in 1890 the average farm contained 137 acres, of which 78 acres were improved. In Cuba the average farm had an area of 142 acres, of which, however, only about 13 acres were under cultivation.

The only measure of agricultural products which was obtained by the census consisted in the area cultivated in each crop. Measured in this way, the following table shows the relative importance of each such crop, expressed in percentages of the total area of cultivated land:

	Per cent.
Coffee	41
Sugar cane	15
Bananas	14
Sweet potatoes	8
Indian corn	4
Malangas [Colocasia, Xanthosoma ?]	2
Rice	2
Cocoanuts	1
Tobacco	1

From the above it is seen that coffee is much the most important crop of the island; that sugar cane is of much less relative importance than in Cuba, and that tobacco, which is one of the leading crops of Cuba, is here of trifling importance.

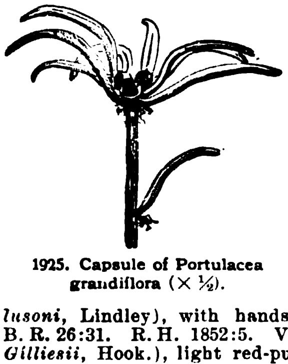
To illustrate the tenure of land under different crops and the race of the occupant, the following table is presented, showing, for different tenures and races in percentages, the proportion which was planted in each of the different crops above enumerated:

Crop.	White owners.	White renters.	Colored owners.	Colored renters.	Others.
Tobacco	1	3	1	2	1
Sugar cane	14	47	2	10	31
Rice	2	2	3	3	1
Sweet potatoes	7	8	15	3	5
Malangas	2	2	5	4	1
Yams		4	8	1	
Bananas	15	8	17	13	11
Cocoanuts	1	1	13	3	2
Coffee	47	18	31	22	34
Indian corn	4	4	5	5	2

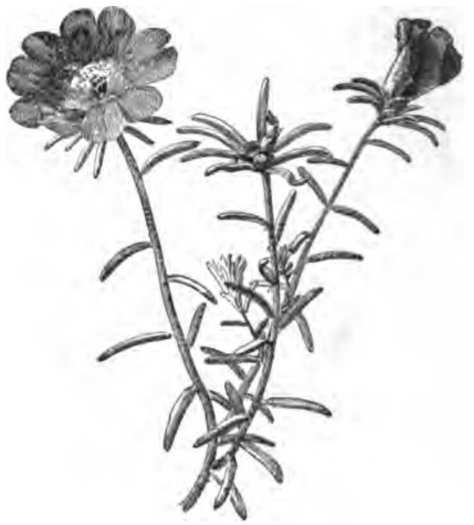
It is seen from the above table that of the cultivated area owned by whites 47 per cent, or nearly half, was planted in coffee. Bananas occupied 15 per cent, and sugar cane 14 per cent. Of the area rented by whites, on the contrary, 47 per cent was planted in sugar cane and but 18 per cent in coffee. This distribution of crops among the areas owned by negroes was wider, coffee occupying nearly one-third of the area, while sugar cane, the second most important crop in the island, occupied only 2 per cent. Among colored renters the areas were also widely scattered.

PORTULÀCA (Latin name, of uncertain history). *Portulacàceæ.* PURSLANE. Low, fleshy, often trailing, annual or perennial herbs, of perhaps 20 species, in tropical and temperate regions, mostly American. Lvs. mostly alternate, thick, sometimes terete, entire: fls. mostly terminal, usually with 5 distinct petals and with several to many stamens, both borne on the calyx or receptacle-rim: fr. a small, conical, circumscissile capsule (Fig. 1917), containing many small seeds. The flowers of Portulaca open in direct sunshine, but close in shadow. Two annual species are in cultivation, both thriving in the hottest exposures.

grandiflòra, Hook. ROSE MOSS. Figs. 1925–6. Stem slender and terete, prostrate or ascending, not rising over 6–10 in., hairy in tufts at the joints: lvs. scattered or somewhat clustered, short and terete: fls. large (usually 1 in. or more across in the cult. forms), terminal and subtended by clustered lvs., in many bright colors, soon withering: seeds small, metallic-gray or gray-black. Brazil and S. B.M. 2885. R.H. 1877:90. Gn. 45, p. 436.—Said to be perennial under glass. Runs into many garden forms, as: Var. **Théllusonii,** Hort. (*P. Théllusoni*, Lindley), with handsome orange-scarlet fls. B. R. 26:31. R. H. 1852:5. Var. **spléndens,** Hort. (*P. Gilliesii*, Hook.), light red-purple. B.M. 3064. Var. **albiflòra,** Hort., clear white. Var. **sulphùrea** or **Thórburni,** Hort., dark yellow. Var. **caryophylloides,** Hort., red, striped white. Var. **Bédmanni,** Hort., clear white and purple striped. Colors of the cultivated Portulacas range from pure white to yellow, rose, scarlet, deep red, and almost purple, with many striped forms. There are also many full double strains. The Rose Moss is most easy of culture if it is given a hot and rather dry soil. It needs full sun. The seeds require a rather high temperature for germination, and therefore they are sown rather late,—not until corn-planting time. Sometimes they are started indoors, but usually they are sown directly where the plants are to stand. The soil need not be rich. The plant makes excellent edgings, and is good for growing in dry rockwork. A large patch of it gives a brilliant display of color in sunny weather, but the flowers do not open in dull weather. Seed of the double varieties produces more or less single-flowered plants, unless saved from cuttings of double-flowered plants, but the singles usually bloom earlier than the doubles. Let the plants stand 10–12 inches apart. They are tender to frost. The plant often self-sows, and in some places it persists about old gardens. *Portulaca grandiflora* was first described by Hooker in 1829 in the Botanical Magazine. The flowers were described as "orange-colored, or of a very bright reddish purple." The plant was "discovered by Dr. Gillies, growing in light sandy soil, in various situations between the Rio del Saladillo, or western boundary of the Pampas, and the foot of the mountains near Mendoza. On the western side of Rio Desaguardero plants were in great profusion, giving to the ground over which they were spread a rich purple hue, here and there marked with spots of an orange color, from the orange-colored variety which grew intermixed with the others."



1925. Capsule of Portulacea grandiflora (× ½).



1926. Portulaca grandiflora (× ½).

1947. Portulaca oleracea, the common Purslane (× ⅓).

oleràcea, Linn. PURSLANE. PUSLEY Figs. 1927, 1928. A common trailing weed in sandy ground, but also cultivated in improved strains as a pot-herb: lvs. small, spatulate or narrow-obovate, very obtuse, thick, dull green or reddish: fls. small, yellow, the 7–12 stamens sensitive to a touch. Widely distributed in many countries; probably native to the southwestern parts of the U. S., but it is considered that it is introduced into the East and North. In sandy and loamy soils it is one of the commonest and most persistent of weeds, but it is little known on heavy lands. The common wild plant is prized for "greens" in some regions, but the French upright forms (Fig. 1928) are much better, as they are larger and more tender; these improved varieties look very different from the common "Pusley"; they are easy of culture. For a discussion respecting the nativity of Purslane in North America, see Gray & Trumbull, Amer. Jour. Sci. 25, p. 253. L. H. B.

1928. Portulaca oleracea, the cultivated upright form (× ⅛).

POSOQUÈRIA (from a native name in Guiana). *Rubiàceæ.* About a dozen tropical American glabrous trees and shrubs with thick opposite entire lvs., tubular fragrant white, rose or scarlet fls. in terminal corymbs, and a berry-like fruit. The fls. are 5-merous: ovary 1-2-loculed, the style with 2-parted stigma. Several species are mentioned in Old World horticultural literature, all warmhouse plants, but only one has appeared in the American trade, **P. longiflòra**, Aubl. (sometimes erroneously written *P. longifolia*). This species is native to French Guiana. It is a handsome free-flowering bush 5–8 ft. high: lvs. oblong-acuminate, narrowed at the base, thick and shining: fls. 12 or more in a cluster, 3–5 in. long, waxy white, very fragrant, the slender tube curved, hairy in the throat. Prop. by cuttings of ripening wood. L. H. B.

POT. See *Potting* and *Pots*.

POTAMOGÈTON (compound of Greek words signifying that these are *river plants*). *Naiadàceæ.* POND-WEED. A rather large genus (50 or 60 species) of aquatic plants in temperate and sometimes in tropical regions, a few of which are sometimes grown in aquaria and ponds. Nearly 40 species are native to North America. They are weedy plants, attaching themselves to the bottom in ponds, lake margins and in shallow streams, and holding their small spikes of inconspicuous flowers above the water in midsummer. In many of the species there are two kinds of leaves, the narrow submerged ones and the broad floating ones. The small perfect flowers have 4 greenish perianth-segments, 4 stamens, and usually 4 sessile 1-ovuled ovaries: fr. a nutlet with a coiled or hooked embryo. The Potamogetons are very difficult plants for the systematic botanists, and it is not worth while to describe any of the species here. There are none which are generally known in the trade. They are likely to be weeds in lily ponds. For the Amer. species, see Morong, Mem. Torr. Club, 3, No. 2; also the current manuals. Three species have come into slight notice in American gardens: **P. críspus**, Linn., and **P. nàtans**, Linn., natives, and **P. dénsus**, Linn., European. Easily grown. L. H. B.

POTASH. See *Fertilizers* and *Fertility*.

POTATO is one of the most widely cultivated and valuable of esculent tubers. It is *Solanum tuberosum* of the botanists, and is allied to several powerful narcotics, such as tobacco, henbane and belladonna, and also to the tomato, eggplant and capsicum. The Potato is a native of the elevated valleys of Chile, Peru and Mexico, and a form of it is found in southern Colorado (see *Solanum*). It probably was carried to Spain from Peru early in the sixteenth century. It seems to have been introduced into Europe as early as 1565. Sir Walter Raleigh, in 1585, is said to have brought back the Potato from the "new country." Recent investigation, however, seems to give the credit of introducing the Potato into England to Sir Francis Drake, in 1586. As *Batatas Virginiana* it was figured and described by Gerarde in 1597. It is probable that these circumstances led to erroneously giving the credit of introducing the Potato to Raleigh instead of to Sir John Hawkins. The wild varieties in their native habitat still bear a close resemblance to cultivated varieties except for the enlarged vine and abnormal development of the tubers in the latter. During the seventeenth century the Potato was cultivated in gardens in several European countries. It was recommended by the Royal Society of London in 1663 for introduction into Ireland as a safeguard against famine. The cultivation of the Potato as a field crop became somewhat common in Germany soon after 1772, at which time the grain crops failed and Potatoes were a welcome substitute for the bread-corn. It was near the middle of the eighteenth century before it acquired any real importance in Europe, outside of Ireland and a few restricted localities in other countries. As late as 1771 only a white and red variety were mentioned in one of the most important English works on gardening. The plants were enormously productive, but the tubers were poor in quality, so poor in fact that their chief use was as food for domestic animals; and only when the bread-corns failed were they used to any extent, and even then as a substitute. By 1840 the Potato had been largely substituted in Ireland for the cereals and other similar food crops, as the yield of Potatoes in weight exceeded by twenty to thirty times the yield of wheat, barley or oats on an equal amount of land. This large dependence on a single food crop finally resulted in a wide-spread famine. The Potato blight which appeared in the United States in 1845 devastated Ireland in 1846. During two years, 1846 and 1847, a conservative estimate places the numbers who perished for want of food or from diseases caused by a meager diet of unhealthy and unnutritious food at 600,000. By 1848 the plague had virtually disappeared.

The roots of the Potato are distinct from the tubers. Usually, two to four roots start from the stalk at the base of each underground stem which, when enlarged at the end, forms the Potato. See Fig. 1929. Roots may also start where underground stems are wanting. The Potato is a perennial plant. The accumulated starch in the tubers furnishes an abundant supply of nourishment for the plants growing from the eyes or buds until they are well above ground. So much food is stored that not infrequently small young tubers are formed on the outside of Potatoes left in the cellar during the summer. Potatoes grow from two to even three feet high, have smooth, herbaceous stems, irregularly pinnate leaves, and wheel-shaped flowers (Fig. 1930) varying in breadth from 1 to 1½ inches and in color from bluish white to purple. They bear a globular purplish or yellowish fruit or seed-ball of the size of a gooseberry, containing many small seeds.

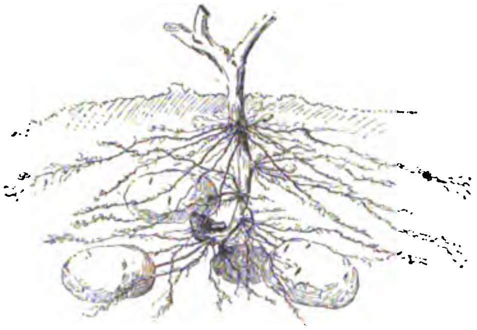
The dry matter of Potatoes is composed largely of starch. Being deficient in nitrogen, the Potato is ill-adapted for an exclusive diet, and should be used in connection with food containing a high percentage of proteids, such as lean meats, peas, beans and eggs. The lack of vegetable fats may be supplied by butter, gravy, and oaten meal. The composition of the Potato varies widely. An average of 136 analyses is as follows:

	Water.	Ash.	Protein.	Starch.	Fat.
	%	%	%	%	%
Potatoes...............	78	1	2.2	18	.1
Oat meal..............	7.9	2	14.7	67.4	7.1
Graham flour	13.1	1.8	11.7	69.8	1.7

The nutritive ratio of wheat is 1 to 5.37, almost perfect; that of Potatoes 1 to 18.29, entirely too wide. Many foods, in their natural state, as Potatoes, are more or less deficient in mineral matter. Notable among these are rice and wheaten flour—the former containing but 0.4 per cent and the latter 0.5 per cent of ash.

Notwithstanding the fact that the Potato alone forms an unbalanced ration, it is used more universally as a food than any other esculent vegetable in localities adapted to its growth. Potatoes contain a small amount of a somewhat poisonous substance. When exposed to the direct rays of the sun for some time and "greened," the deleterious substance is so greatly increased that the water in which they are boiled is not infrequently used to destroy vermin on domestic animals. In any case the water in which Potatoes are cooked should not be used in the preparation of other foods.

There are many hundred varieties of Potatoes. New varieties are constantly supplanting the old ones. As new varieties are usually produced under superior conditions, when they are placed in field culture and under more difficult conditions they tend to degenerate. Old varieties which have "run out" often find their way into a locality where conditions are superior. Here their valuable qualities may be restored or even increased, and they are then generally reintroduced under a new name (see Bailey, "Survival of the Unlike," for discussion of the running out of Potatoes). Usually new varieties are secured from seeds, but the seeds of a single ball cannot be depended upon to propagate the parent type. The tubers of the most promising seedling varieties are planted, placed under superior conditions, and out of many hundred varieties tested, a single one may prove to be worthy of introduction. The world owes much to Rev. Chauncey E. Goodrich, of Utica, N. Y., for his painstaking efforts not only to improve the Potato, but also for originating and introducing several valuable varieties. The acquired habit of producing enlarged underground stems has been so greatly accentuated that the normal tendency to produce seed-balls has been nearly obliterated, especially in the early varieties. The Potato is sensitive to frost and therefore must complete its growth in most localities in from three to six months. The period of development may be shortened by exposing the seed Potatoes to the more or less direct rays of the sun in a temperature of about 60° for one to two weeks before planting. Some of the starch is transformed into sugar, which causes the eyes or buds to develop into miniature, short, tough plants or "rosettes," which results, when the Potatoes are planted, in hastening growth and shortening the period between planting and harvesting. Some varieties, when thus treated and planted in warm, rich, sandy soil, produce merchantable tubers in six weeks. In cutting Potatoes for planting, each eye should be supplied with an abundance of food to start the young plants off vigorously: the pieces should be as large as possible and yet not bear more than one or two eyes (Fig. 1931). While the late varieties thrive best in a moist, cloudy climate and in a rich, loamy soil, Potatoes may be successfully produced in light soils and under cloudless skies. Dryish, sandy or sandy loam soils not only produce earlier Potatoes than cold, damp lands, but tubers of a better quality. "Mealy" Potatoes contain less moisture than do those which remain somewhat hard when cooked. Americans prefer the former; most Europeans the latter.

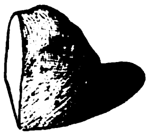


1929. Underground parts of Potato plant.

Showing the fibrous roots and the stems ending in tubers. The old seed-piece is seen near the bottom.

1930. Flowers and foliage of Potato (× ⅓).

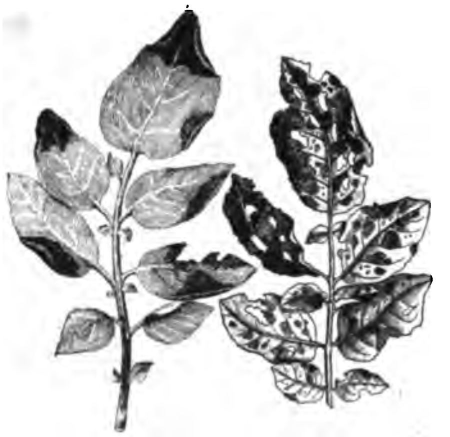
For market-gardening, varieties such as Early Rose are planted 2 to 3 inches deep in dry, warm soils, as soon as danger from frost has passed. Level tillage is practiced until the vines are nearly full grown, when the rows are slightly hilled by passing an implement, provided with a single large shovel with or without wing-attachments, between the rows. A threefold effect is secured: weeds are destroyed; the land is raised into ridges, whereby the soil is made warmer and drier, thus inducing early fruitage; the young Potatoes are prevented from becoming green by exposure to the sun. Most early varieties have a tendency to set tubers near the surface. Sandy lands, which are well suited to raising early Potatoes, are too frequently deficient in plant-food, and resort is had to either barn manure or chemical fertilizers. The former, especially if not fully rotted, increases the tendency to produce rough or scabby Potatoes, while the use of chemical manures containing but a small percentage of nitrogen tends to produce smooth tubers of a high quality. A liberal dressing for an acre is 20 lbs. of ammonium sulfate, 80 lbs. of dried blood, 150 lbs. of acid phosphate and 150 lbs. of muriate of potash. These would furnish 17, 21 and 75 lbs., respectively, of the plant-foods named. These concentrated fertilizers should be thoroughly mixed and incorporated with the soil by passing a small single-shoveled plow along the open marks made to receive the seed Potatoes. Market-gardeners often use wood ashes at the rate of 50 to 80 bushels per acre.



1931. A good cutting or seed-piece.

Frequently a second crop follows the early Potatoes. In any case a cover-crop (peas, clover or winter vetches) should be sown after the Potatoes are dug if no second harvest crop follows; if it does follow, then a cover-crop may be sown at or just before the last inter-culture is given. In any case, provide some kind of a cover-crop to digest the plant-food, to afford humus and conserve nitrogen for succeeding crops, and to cover the land during the rainy and cold winter periods when the soil would otherwise be idle and losing fertility.

Late Potatoes are planted three or four weeks after the early ones and about two inches deeper. Inter-tillage should be given about every ten days, keeping the ground practically level, and be continued late in the season, that an earth-mulch may be kept intact to conserve moisture during the hot, dry period when the young tubers are forming. Three to four tillings may suffice for early Potatoes, six to seven for late varieties.


1932. Potato blight.
True or late blight on the left; early blight on the right.

The yield per acre of Potatoes in the United States is meager, 88.6 bus. being the average for 1899. Under favorable soil and climatic conditions, with rational methods of procedure, 200 to 400 bus. are not uncommon, and under superior conditions more than 1,000 bus. per acre have been secured. H. C. Pierson, of Pitcairn, N. Y., won first prize for the largest amount of Potatoes grown from one pound of seed in a single season. By dividing the eyes and planting them in the greenhouse in the winter, and after a little time re-dividing them, and this continued until many plants were secured, he was enabled to raise 2,558 lbs. of Potatoes in the open from one pound of seed, being an increase of more than 2,500 fold. A. P. Rose, of Penn Yan, N. Y., and C. F. Thompson, of Lee, N. H., secured, by similar methods, 2,349 lbs. and 2,118 lbs. respectively. The low average yield is due, in part, to the ravages of the many enemies of the Potato plant, which, uncontrolled, sometimes destroy the crop, and usually seriously diminish the yield. In the United States the Potato is not so universally used as in Europe, though its use as a food is steadily increasing. The average annual production in the U. S. from 1881 to 1890 was 169,809,053 bus., while the yield in 1899 was 228,783,232 bus., which sold for an average price of thirty-nine cents per bushel. New York stands first in Potato production, producing 28,707,976 bus. of the total yield. The crop of Europe aggregates more than the entire wheat crop of the world. The average production of the European countries from 1881 to 1890 was: France, 396,746,138 bus.; Austria, 306,984,697; Germany, 891,732,040; Russia, 300,315,070; the United Kingdom, 228,093,397 bus. In 1898 the United States exported 581,833 bus. and imported 530,420 bus. For further information, consult the Experiment Station bulletins, Carman's "New Potato Culture" and Terry's "A B C of Potato Culture"; also bulletins and reports of various experiment stations.

The most common enemy to the Potato plant, the Colorado Potato bug, is easily destroyed by applications in a powder or in a liquid of Paris green to the vines when the bugs first appear. The fungus *Phytophthora infestans* causes the true blight (Fig. 1932), which results in the potato-rot. The true blight may be kept in check by frequent and thorough sprayings with Bordeaux mixture. It is always well to incorporate Paris green with the mixture that any remaining bugs may be destroyed. The Bordeaux mixture is also useful in protecting in part the plants from the flea-beetle. Two or three applications are usually made during the summer. The early blight is more common than the true or late blight. It causes the shriveling and death of the foliage (Fig. 1932). It is usually the combined result of several causes, chief amongst which are fungi, flea-beetle, drought. Thorough good care and spraying with Bordeaux mixture are the best treatments. A good Potato field should look like that in Fig. 1933 (adapted from American Agriculturist); and the picture also shows a good spraying rig.

I. P. ROBERTS.

POTATO CULTURE AT NORFOLK.—The Irish Potato crop at Norfolk, Va., reaches about a half million barrels annually. It is planted in February and March, and marketed in June and July—say from June 20 to July 20.

The land for Potatoes ranges from a sandy loam to a clayey loam, all on a subsoil of clay. Some years the higher sandy lands do the best, sometimes the lower more clayey lands give the best results, depending on the amount and distribution of the rainfall, which is generally from 4 to 6 inches per month. The land is plowed with a two-horse plow, in October, November, or December, and then lies until some time in January or February, depending on the character of the winter. It is then replowed, and harrowed down level and smooth; as the land is mellow it all works down as pliable and as fine as the best of garden soil. If Potatoes are to be grown alone on the land, the rows are laid out with a single plow, turning out a furrow, nearly down to the subsoil, and 2½ ft. apart. Fertilizer to the amount of 800 or 1,000 lbs. to the acre is drilled into the furrows, and a little plow with a sort of subsoil attachment is run in the row to mix the fertilizer with the earth, and to stir up the hard soil at the bottom of the furrow.

The seed Potatoes are cut to one eye, and dropped about 12 to 15 in. apart, and then covered with a small turning plow with two furrows. As soon as the Potato begins to sprout well, and before it has made its appearance, a smoothing harrow is run across the rows, cutting off the top of the ridges and bringing the Potato sprouts near to the surface. This kills all the early growth of weeds and leaves the land in good condition for the tender plants to break through. As soon as the rows can be followed, a single plow is run along the sides of the row, turning the earth away from the row on both sides. Then a Breed or a Hallock weeder, or any other good weeder, is run over the field, crossing the rows as far as possible at right angles. This leaves the land free from grass or weeds; and the remainder of the cultivation consists in turning the dirt well to the rows; then a short campaign against the potato bug, and the crop is made. About half of the seed used is home-grown. To secure this home seed, a second crop of Potatoes is grown, using seed taken from the first crop, planting about August 1. This second crop stands until the first autumn frosts, say some time in November, and then it is plowed out, and the larger

1933. Spraying Potatoes.

Potatoes are used for market, the smaller ones for seed. Many people prefer this to the seed purchased from Maine or Michigan. The seed is cut to one eye, and about two barrels is necessary to use in planting one acre. Some farmers apply less fertilizer, provided their land is in good heart or productive condition; some apply a part of the fertilizer at the bottom of the drill, and the balance at the side of the row when the dirt is turned away from the row. One good thorough application of Paris green or London purple at the right time destroys the bug, although most farmers have to go over their fields two or more times.

In digging, most farmers use the common two-horse plow, running the plow under the row and lifting all the Potatoes out, still attached to the vine, as the vine is always green at time of digging, and the Potatoes are firmly attached thereto. The hands then follow and lift up the vines with the Potatoes attached, put the Potatoes in barrels at 10 cents per barrel. Barrels are then headed up, by firmly nailing on a canvas cover, and placed in farm wagons to be hauled to the city or to some near-by watercourse or railway, for shipment to the great markets in the U. S. east of the Mississippi and north of the Ohio, and all the Atlantic seaboard markets. The cost of barrel is about 20 cents each, including the cover. The freight is 18 cents per barrel to Baltimore and Washington, 20 cents to New York and Philadelphia, and about 30 cents to Boston. The Potatoes are handled by commission men at the different markets at 8 per cent commission.

1934. Potato-growing in the Dismal Swamp, Va.

The yield will run from 40 to 60 and even to 80 barrels to the acre and the price from $1 to $3 per barrel; the yield depending, of course, upon the soil, the season, and the cultivation; the price depending on the old crop on hand, the condition of the consuming masses, whether it is the year of presidential election or not, and the character, condition, and earliness of the Potato sections coming in competition with this section.

Sometimes the Potato rows are made farther apart and berries are set in between the rows. Often the Potato crop is followed by corn the same season, making two fine staple farm crops from the same land the same season. Sometimes these second crops of corn are sown full of cow-peas at the last working of the corn, and then such a mass of vegetation is grown that it is almost impossible to turn it under after the corn is harvested. Some of the finest Potato land is found on the margins of the famous Dismal Swamp, a few miles south of Norfolk, Va. Fig. 1934. Whenever the seasons are a little inclined to be dry, such land turns out the finest and nicest Potatoes to be found anywhere. One grower, whose farm has been reclaimed from what was once the "Swamp," has raised as high as 25,000 barrels in a single season. A navigable arm of the sea ran to within a half mile of his "Potato patch," and a "tram railway" run by mule-power enabled him to put his Potatoes into market as easily and as expeditiously as the man beside him who grew 250 barrels. The scarcity of labor will eventually compel the use of the improved machinery; and the probability is that the acreage devoted to Potatoes is to be lessened instead of increased. A. Jeffers.

Potatoes in the South.—It is an easy matter to grow an early or spring crop of Irish Potatoes in the South, provided the seed tubers can be had. As the crop matures early, it is almost impossible to keep the tubers over the summer and through the succeeding winter in order to plant in the following spring. Therefore it is a common practice to import seed from the North. This difficulty of keeping the seed Potatoes is obviated if a second or fall crop is grown; and this fall crop may also be made to afford a staple supply of food. The greatest problem in Irish Potato-growing in the extreme South is the raising of the fall crop, although the matter is not difficult if a few underlying principles are kept in mind. This article is devoted to the growing of the second or fall crop.

Under favorable conditions profitable crops are grown in the southern states during late summer and fall. Dry, hot weather frequently prevails during the early part of this period; hence the necessity of having the soil, before planting, in a condition to receive and to retain the greatest amount of moisture. Heating manures or other materials that will cause rapid fermentation should not be applied to the soil just at planting time nor during the first month after planting. Land that was thoroughly prepared, highly fertilized and well tilled in some spring crop like cabbage or onions, gives much better results than similar soil broken and fertilized only a short time before planting. Cool, moist, valley lands are better adapted to the fall crop of Potatoes than are the drier, warmer hillsides.

Dormant tubers of the previous year's crop would doubtless insure the best stand; but, as these are difficult to obtain, the majority of growers select seed Potatoes from the spring crop, which matures two or three months before time to plant the second crop. Some growers prefer to let seed Potatoes remain in the soil where they grew until ready to plant the second crop; others dig as soon as the spring crop is matured, spread the Potatoes thinly over a surface protected from sun and rain, and cover lightly with straw or leaf-mold.

In latitude 33°, August 1 to August 15 is sufficiently early to plant. If dry, hot weather prevails it is frequently advantageous to sprout the tubers before planting; otherwise they may lie in the ground several weeks perfectly dormant. This sprouting, or starting the buds, is easily done by the following method: Spread the Potatoes in a cool, shaded place, cover to the depth of 3 or 4 inches with garden loam, sand or leaf-mold, and keep moist (not wet) for about a fortnight, or until the sprouts are an eighth to a quarter of an inch long.

As a rule, conditions for starting Potato plants into vigorous growth are much more favorable in the spring than in August. The plantlet must draw its sustenance from the mother tuber until it is able to imbibe food from the soil; hence the practice of cutting tubers into larger pieces for the summer planting than was necessary in the spring seeding. Cover a little deeper than would be proper for spring seeding; otherwise the manner of planting the early and the late crop is the same. With proper care in preparation of land, very little cultivation is necessary. Once the plants are started into vigorous growth (which comes with the advent of cool weather), the crop develops more rapidly in the fall than in the spring. It is seldom necessary to dig before December 1. Keeping qualities are excellent. For table use they are equal to those from spring harvest, or even better the early crop. As seed Potatoes they are preferred for spring planting.

A. B. McKay.

POTATO, AIR. *Dioscorea bulbifera.*

POTATO ONION. See *Onion.*

POTATO, SWEET. See *Sweet Potato.*

POTENTÍLLA (diminutive of Latin *potens*, powerful; referring to the medicinal properties). *Rosàceæ.* Cinquefoil. Five-finger. A large genus of perennial, rarely annual, herbs or shrubs found throughout the north temperate and frigid zones, and characterized by their compound leaves, 5 bracteoles borne at the base of the 5 sepals, which in turn are borne upon the edge of a cup-shaped, dry receptacle; stamens 10–30, together with the 5 rounded petals inserted upon the margin of the receptacle: pistils many, in fruit becoming minute akenes; styles deciduous. Those in cultivation are all hardy perennial plants suitable for border planting. The most valuable double-fld. forms are hybrids.

K. M. WIEGAND.

The American Potentillas are generally rather unattractive plants with small flowers. They are, as a rule, very tenacious of life and do well with ordinary care. *P. fruticosa*, a handsome and distinct low shrub, prefers moist positions, but will grow in even very dry soil. Where thoroughly established in moist soil it is difficult to eradicate. *P. argentea* should be given a dry soil, preferably about rocks. It is tenacious of life and is quite attractive. *P. Hippiana*, a western species with comparatively large foliage of decided gray color, is hardy east. It is a good perennial preferring dryish soil. *P. tridentata* is an attractive evergreen species forming thick mats. It does well in any fairly rich soil in open or partially shaded positions. Potentillas are prop. by division or seed, the hybrids only by division. *P. fruticosa* may be increased by greenwood cuttings.

F. W. BARCLAY.

Hybrid Potentillas have nearly all the good qualities we look for in a border plant,—handsome foliage and free-blooming habit. They continue in bloom from spring until autumn, although most profusely in June and July. They cannot be said to be reliably hardy in the latitude of Boston, probably not above Washington. They do not grow over two feet and seldom need staking. A heavy soil suits them best. Choice varieties are propagated by division of the rootstock in spring; cuttings will not root. They run mostly in shades of maroon, scarlet and orange, often beautifully banded with yellow. They bear seed freely, and when carefully hybridized we may get a very fine strain with a good proportion of double ones. Seedlings bloom the second year. Some of the species make neat rock plants, especially *P. tridentata*, *P. verna* and *P. argentea*,—the last, though common, is valuable in places in which other plants will not grow.

T. D. HATFIELD.

INDEX.

André, Dr., 16.
argentea, 15.
argyrophylla, 8.
atrosanguinea, 8.
bicolor, 16.
cardinale, 16.
coccinea, 9.
Daudin, 16.
Eldorado, 16.
Emile, 16.
formosa, 9.
fruticosa, 1.
glandulosa, 3.
Gloire de Nancy, 16.
Gordoni, 5.
gracilis, 14.
grandiflora, 7.
Hamlet, 16.
Hapwoodiana, 16.
Hippiana, 2.
hybrida, 16.
insignis, 8.
Ivesia, 5.
laciniata, 13.
laciniosa, 13.
Lemoine, 16.
Mars, 16.
Nepalensis, 9.
O'Briana, 16.
palustris. See Comarum.
perfecta, 16.
purpurea, 16.
Pyrenaica, 12.
Rollinson, Wm., 16.
rupestris, 4.
Russelliana, 16.
Salter, Jeane, 16.
Thurberi, 10.
tridentata, 6.
verna, 11.
versicolor, 16.
Vesuve, 16.

A. *Basal leaves pinnate.*
  B. *Stem shrubby* .... 1. **fruticosa**
  BB. *Stem herbaceous.*
    C. *Lvs. silky, tomentose beneath.* 2. **Hippiana**
    CC. *Lvs. green on both sides.*
      D. *Lfts. large, 1 in. long, dentate* .... 3. **glandulosa**
      4. **rupestris**
      DD. *Lfts. minute, ¼–½ in. long, much divided* .... 5. **Gordoni**
AA. *Basal lvs. palmately 3–7-foliolate.*
  B. *Lfts. 3.*
    C. *Fls. white* .... 6. **tridentata**
    CC. *Fls. yellow or red* .... 7. **grandiflora**
    8. **argyrophylla**
  BB. *Lfts. 5–7* .... 9. **Nepalensis**
    C. *Fls. red or purple* ....10. **Thurberi**
    CC. *Fls. yellow.* 11. **verna**
      D. *Lvs. green beneath*.........12. **Pyrenaica**
      13. **laciniosa**
      14. **gracilis**
      DD. *Lvs. white beneath*.........15. **argentea**

1. **fruticòsa,** Linn. Fig. 1935. Much-branched, 5 in. to 4 ft. high, with peculiar shreddy bark: lvs. all pinnate; lfts. 3–7, small (6–12 lines long), oblong-linear, acute, silky with revolute margins: fls. numerous, bright yellow, showy, 8–16 lines broad; style lateral: akenes, receptacle and disk all long-hairy. Swamps and rocky places, N. Amer., Eu., Asia. J. H. III. 31:602. D. 121.—A useful shrub, flowering throughout the summer.

1935. Potentilla fruticosa (× ⅓).

2. **Hippiàna,** Lehm. Stem erect, stout, 1–2 ft. high, silky, erect-branched above; stipules large, ovate-lanceolate, subentire: basal lvs. rather large; lfts. 3–5 pairs, whitish silky above, tomentose beneath, decreasing in size toward base of leaf, obovate-cuneate, 1–2⅓ in. long, obtusely toothed; cauline lvs. several and similar: fls. deep yellow, ½–1 in. broad, cymose; bracteoles nearly equaling the calyx, acute; petals slightly exceeding the sepals, retuse. Western America.

3. **glandulòsa,** Lindl. Strict, 1–2 ft. high, slender, viscid and glandular-hairy, erect, branched above: lvs. mostly basal, 4–6 in. long; lfts. 3–4 pairs, 1–1¼ in. long, obovate, obtusish, coarsely serrate-dentate, nearly glabrous; cauline lvs. 3-parted: fls. rather large, yellow petals entire, equaling the long-acuminate sepals; styles thickened below, inserted at base of carpel: akenes glabrous. Western U. S.; grows well in dry, sterile ground.

4. **rupéstris,** Linn. Very similar to the last, slightly stouter: fls. larger, nearly white; petals entire, much exceeding the calyx. June, July. Eu.—Grows well in dry, sterile soil.

5. **Górdoni,** Baill. (*Ivèsia Górdoni*, Torr. & Gray). Root stout: caudex woody and cespitose: stems erect, 4–12 in. high, and, like the lvs., glandular-pubescent or glabrous: lvs. mostly basal, numerous; lfts. 10–20 crowded pairs; cauline lvs. few, very small: fls. small and inconspicuous in a crowded cyme; petals yellow, spatulate, shorter than the sepals; stamens only 5; pistils 1–5. Western U. S.; forms dense mats in dry soil.—Possibly generically distinct.

6. **tridentàta,** Soland. Often woody at the base, 1–12 in. high, slender: branches erect-spreading, appressed-pubescent: lvs. mostly basal, long-petioled; lfts. ⅓–1 in. long, oblanceolate, truncate and 2–5-toothed at the apex, cuneate and entire below, coriaceous, dark green, paler beneath: fls. several, small, 3–5 lines broad, in a terminal, nearly naked cyme; petals oval, entire, exceeding the calyx; style lateral, filiform: akenes and receptacle villous. June, July. Northern N. Amer., Greenland, Scotland.—Good for dry banks and rockeries.

7. **grandiflòra,** Linn. Stem leafy, 10–20 in. high, erect, branched, villous: caudex nearly simple: lvs. with appressed-hairy petioles exceeding the broadly obovate-cuneiform, dentate, 1–1½-in. long lfts., which are green and pilose-silky on both sides: fls. numerous, ½–¾ in. in diam.; petals broad, emarginate, much exceeding the acute sepals; akenes glabrous, rugulose: receptacle hairy. June, July. Eu., North Asia.—A good border plant. Differs from the next in the smaller, broader leaflets, green beneath, and the rugulose carpels.

8. **argyrophýlla,** Wall. (*P. insignis*, Royle). Tall and leafy, 2–3 ft. high, stout, silky-hairy or pubescent: lvs. large, long-petioled; lfts. 2–3 in. long, elliptic-ovate or obovate, acutely toothed, white beneath, silky-hairy, rarely glabrous above: fls. yellow, ¾–1¼ in. broad, long, slender-pedicelled; sepals acuminate; petals large, obcordate, exceeding the calyx: akenes smooth; style sub-terminal, receptacle villous. June, July. Himalayas. Var. **atrosanguínea,** Hooker (*P. atrosanguinea*, Lodd.).—Fls. red or purple, same range. One of the most common species in cultivation and extensively hybridized with *P. Nepalensis*, giving rise to most of the hybrid Potentillas of the trade.

9. **Nepalénsis,** Hook. (*P. formòsa*, Don. *P. coccínea*, Hoffm.). Erect, 1½–2 ft. high, from a woody rootstock, few-fld., clothed with long, soft, spreading hairs, leafy-branched: lower lvs. 5–7-foliate, often 12 in. long; lfts. (2–3 in. long) obovate or elliptic-obovate, acute or obtuse, coarsely serrate, green, base entire: fls. 8–12 lines broad, purple; petals obcordate, twice the length of the acute sepals; bracteoles obtuse: akenes minute, glabrous, wrinkled; receptacle hairy. May, June. Himalayas. —A fine species.

10. **Thúrberi,** Gray. Similar to the last, but stem ascending, more slender and finely pubescent: lvs. little paler beneath, 1–2 in. long, coarsely toothed or almost crenate, thinner, smaller and less veiny: bracteoles lanceolate, acute. June, August. Southwestern U. S.—Good for border planting.

11. **vérna,** Linn. Stems 4–10 in. long, spreading or procumbent, sometimes creeping, forming a thick turf, much branched from the base, more or less hispid: radical lvs. small; lfts. 5–7, broadly obovate-cuneiform, dentate, 4–6 lines long: upper lvs. sessile, ternate: fls. many, of medium size, obscurely cymose; petals obcordate, little exceeding the calyx; bracteoles similar to the sepals; akenes smooth; receptacle hairy. April, May. Dry or stony places, Europe.—For banks and rockeries.

12. **Pyrenàica,** Ram. Stem branched below, 6–15 in. long, decumbent at base, then ascending: radical lvs. long-petioled, hirsute or nearly glabrous; lfts. oblong, toothed above with subacute teeth, terminal tooth of equal size; stem-lvs. few, similar: lvs. numerous; sepals and bracteoles similar, acutish; petals longer than the calyx, obcordate: carpels smooth; receptacle hairy. Aug. Europe.—Larger than the last and less prostrate: lfts. larger, more oblong: fls. larger.

13. **laciniòsa,** Wald. & Kit. (*P. laciniàta*, Amer. Hort. ?). Erect and forming clumps 1–2 ft. high, sparingly hirsute, reddish: lvs. with 5–8 broadly oblanceolate-oblong, 2–3-in. long, deeply laciniate-pinnatifid and pilose lfts.: fls. in much-branched cymes; sepals lanceolate; petals bright yellow, emarginate, much longer than the calyx: akenes rugose; style terminal. Hungary; grows well in dry ground.—Closely related to *P. recta*. Differs from the two preceding in the larger size, stiff, erect habit, larger lvs. and rugose akenes.

14. **grácilis,** Dougl. Erect and rather tall (about 2 ft. high), more or less whitened with silky hairs and tomentum: basal lvs. long-petioled; lfts. obovate or oblanceolate, 1–2 in. long, deeply and regularly incised-dentate, silky above, rarely glabrous, white-tomentose beneath; stem-lvs. similar but smaller: fls. many in a terminal cyme; corolla 6–9 lines broad, showy; petals obcordate, exceeding the acuminate sepals: carpels glabrous. Western N. Amer.—Some specimens in cult. may be *P. Blaschkeàna*, Turc.

15. **argéntea,** Linn. Ascending or procumbent, tufted, branched from the base, 4–12 in. long, more or less white-tomentose, leafy: lfts. 6–12 lines long, obovate-oblanceolate, cuneate, deeply incised with narrow teeth and revolute margins, dark green above, white beneath: fls. few, cymose, 2–4 lines broad; sepals ovate-acute, slightly shorter than the rounded petals; styles filiform, terminal: akenes glabrous. May–Sept. Dry, sterile soil throughout the whole north temperate zone.

16. Hybrid Potentillas, originally from *P. argyrophylla*, var. *atrosanguinea* and *P. Nepalensis* (see Gn. 16:207): *Single-flowered*.—Hapwoodiana, lfts. 5–6, petals at base deep rose, at center pale rose, margins whitish; Russelliana, scarlet-fire-red, large: lfts. 3. *Double-flowered*.—Bicolor Plena, orange and vermilion; Cardinale, brilliant cardinal; Dr. André, golden yellow, suffused with vermilion; Eldorado, purple suffused with yellow; Emile, bright bronzy red; Gloire de Nancy, golden yellow; Hamlet, dark carmine; Hybrida, name applied to various hybrids, R. H. 1890, p. 305; Jeane Salter, orange shaded scarlet; Le Vesuve, floriferous, light red margined with yellow or scarlet; Mars, dark velvety red; M. Daudin, beautiful amber; O'Briana, pink and salmon; Perfecta, maroon shaded lemon; Purpurea, deep purple; Purpurea lutea plena, dark purple, double; Versicolor, carmine and yellow-flaked; Victor Lemoine, light red striped with yellow; Wm. Rollinson, mahogany brown suffused with orange.

P. anserina, Linn. SILVER-WEED. Spreading by runners, low, white-tomentose: lvs. radical, pinnate: fls. yellow. Gravelly lake shores. Very decorative. Eu., N. Amer.—*P. Canadénsis*, Linn. Prostrate or creeping: lvs. green, palmately 3–5-foliolate: fls. few, yellow. N. Amer. Good for dry, sterile soil. Mn. 3:38.—*P. Mílleri*, Hort. A trade name not determined. Woolson says, "Colorado; 12–18 in. high. Plant densely white-tomentose, branching. Fls. bright yellow, a half inch or more across."—*P. récta*, Linn. Close to P. laciniosa, tall, with handsome palmate foliage: fls. deep yellow, worthy of cult. Eu.—*P. Salesoviàna*. See B.M. 7258.—*P. sulphùrea*, Lam. Similar to P. recta, but fls. pale yellow and larger. Fine decorative plant. Eu., introduced in Amer. K. M. WIEGAND.

POTÈRIUM (Greek for *drinking cup;* because the foliage of one species was used in the preparation of a medicinal drink). *Rosàceæ*. Linnæus placed certain rosaceous plants in the genera Poterium and Sanguisorba, the latter having precedence of publication. Many subsequent authors have united these genera, and they are so treated in Gray's Manual. Focke, however (Engler and Prantl, Die Natürlichen Pflanzenfamilien), re-defines the genus Poterium to include one species, the *P. spinosum* of South Europe, allowing the other species to remain in Sanguisorba. As thus understood, Poterium is monœcious, the lower fls. in the spike staminate, the upper pistillate, the stamens many and hanging, the styles 2, the fr. somewhat fleshy, colored, and inclosed in the calyx, the leaves pinnate. **P. spinòsum,** Linn., is a small spiny shrub with nearly glabrous serrate leaflets, somewhat downy branches, small greenish fls. in oblong spikes and reddish berry-like fr. It is offered in S. Calif. Grows 3 ft., the branchlets ending in spines. Said to be a very interesting ornamental under-shrub.

For *P. Canadense* and *P. Sanguisorba*, see *Sanguisorba*. L. H. B.

PÒTHOS (*Potha* is said to be a Ceylonese name). *Aràceæ*. Between 30 and 40 tall-climbing branching shrubs (more or less herbaceous as known in cultivation) of the oriental tropics; leaves thick and often shining, entire or lobed, sometimes blotched or variegated. The species are warmhouse foliage plants, requiring the same general treatment as Philodendron (which see). Five names are in the American trade, but not all of them belong to Pothos. In fact, the genus Pothos is very ill-defined in cultivation because species are named before flowers and fruits are known and determinations are often wrongly made. Some of them are to be referred to Scindapsus and others perhaps to Rhaphidophora. The fls. are small and perfect, crowded on a spadix, with 6 perianth-segments and 6 stamens, the ovary 3-loculed and with a rounded or mushroom-like sessile stigma: fr. a 1–3-seeded berry: spathe usually persistent and wide-spreading or deflexed at maturity. Rhaphidophora has an oblong or linear stigma. The species of Pothos send out cord-like roots that cling to damp walls. For *P. argyræa*, see *Scindapsus pictus*, var. For monograph, see Engler, DC. Monogr. Phaner. 2.

A. *Lvs. green, not banded or mottled.*

celatocaúlis, N. E. Brown. Rapid-growing climber, with stems flat on the under side and lying close to its support: lvs. distichous and overlapping, broad-elliptic, somewhat oblique, sessile, strongly many-veined, dark velvety green. Borneo. F.S. 23:2419, 2420. I.H. 30:496. —First described in 1880 in England. A very odd plant.

nitens, Bull. Lvs. obliquely ovate-acute, cordate at base, shining purplish green. Malaya.

AA. *Lvs. mottled or banded.*

aúreus, Linden. Fig. 1936. Strong evergreen climber with cordate-ovate-acute lvs., which are variously blotched and mottled with yellowish white, the body color being bright green. Solomon Isl. I.H. 27:381. S.H. 1:334.—The generic position of this plant—which is one of the commonest ones in cult.—is in doubt. It probably belongs to Rhaphidophora, possibly to Scindapsus. In a dark place the handsome markings of the leaves tend to disappear. Branches will grow in water for a time. Prop. by cuttings or layers.

argénteus, Bull. Lvs. obliquely ovate-acuminate, silvery gray, with a deep green margin and a deep green band along the midrib. Borneo.

L. H. B.

POTHUÁVA. See *Æchmea.*

POT MARIGOLD. See *Calendula.*

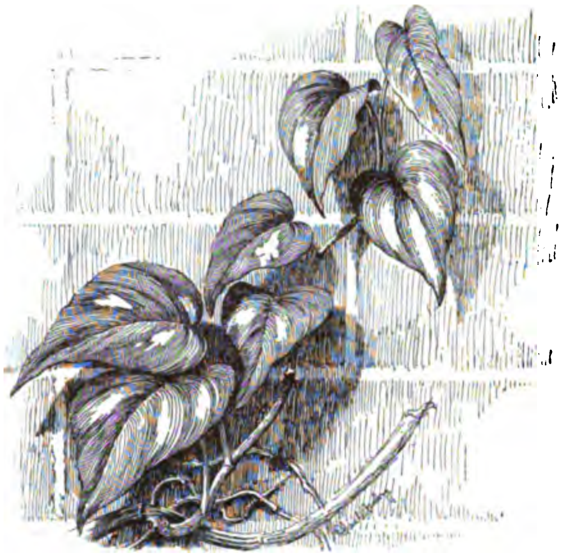
POTS. Before beginning an historical sketch of the manufacture of flower pots in America the writer may perhaps be pardoned for stating that the firm which he represents is one of the thirty-one firms eligible to the Century Club, which consists of firms that have had an uninterrupted ancestral record of one hundred years or more in the same business. Other memberships in the Century Club of interest to horticulturists are those of J. M. Thorburn & Co., of New York, and D. Landreth & Co., of Philadelphia. The business of making flower pots has been in the direct line of the writer's family for four generations without a break, and this indicates the age of the business in this country.

The first entry in our oldest account book reads as follows: Weston, April 19, 1775, Lemuel Jones, to Ware, debtor: 0£ 2s. 8d. From 1788 to 1810, a period of 21 years, we have a continuous account. The charges during that entire term cover about as many pages as we now often use in a day; and the amount in dollars and cents does not compare with single sales of the year 1900. Through all the years up to 1807 the term "flower pots" does not once appear, and the writer very much regrets that the first sale of flower pots and the name of the purchaser cannot be found.

The readers of this article who can remember the year 1861 will recall the depressed condition of business after war was actually declared. The members of the Hews firm felt sure that there would be no demand for flower pots, they being more of a luxury than a necessity, and that the factory must close. At that time the writer succeeded in getting permission to make his first venture as salesman "on the road." Going first to C. M. Hovey, he secured what was a good order for those times, some 10,000 or more pots for the spring trade of 1862. Not once after that, during the Civil War, was the firm able, during the spring and fall rush, to fill all their orders for flower pots. It is not that these orders were remarkably large or numerous, but they were beyond the capacity of the firm.

The writer's own records go back to 1866. At that time prices were a third or a half higher than they are to-day, which is more than the writer would be willing to admit of the relative excellence of the goods. We first got fairly under way with machinery for making small flower pots in 1869. The father of the undersigned, always disposed to be a little cautious, thought that we should overstock the country and ruin the prices. We did in that year what we thought was a wonderful business in flower pots. We exceeded it by a third in the month of October, 1894.

Until about 1864 or 1865 common flower pots throughout the world had always been made by hand on the potter's wheel. There had been, indeed, many different forms of this wheel, but it had always been propelled by hand or foot power. When, in the early fifties, a wheel was made to be propelled by the foot, with two sizes of pulleys and a balance wheel whereby the speed of the wheel was increased in the proportion of three to one, it was thought that perfection had been reached. Much time, though very little money, had been spent previous to the fifties in attempts to make a pot machine. It was left to William Linton, of Baltimore, an experienced practical potter, to perfect and patent the first machine. From him we purchased two machines and the exclusive right to use them in Massachusetts. In a short time we were able to make great improvements on his patent. America was far ahead of Europe in this kind of machinery, as also in improved machinery in general. It is probably safe to say that from time immemorial down to about the year 1863, flower pots had always been made in one general way—by hand, on a potter's wheel.



1936. Pothos aureus of the horticulturists (× ⅙).

The machine made only small pots, up to about 5 inches in diameter; and while it had previously taken an experienced man to make his thousand 3-inch pots in 10 hours, a smart boy without any previous experience whatever could make three thousand on the machine in the same time.

When the standard pot was adopted, about 10 years ago, the hand process was practically abandoned in the principal potteries in favor of what is technically called the jigger. This is a revolving disk propelled by machinery. These disks, or jigger-heads, are made of different sizes and fitted with various rings. Plaster molds are made in very large numbers for each size of pots, and the larger standard pots (6–12-inch) are all made at the present time in these molds. With us, pots from 12–24 in. in diam. are made as of yore by hand on the wheel.

The making of the pot is not its only cost: previous to that comes the preparation of the clay. The hundred years from 1765 to 1865 saw no improvement in the process of preparing it for use. It was ground in a wooden tank or tub, propelled by an ox. The various other processes remained as crude in 1865 as they had been the century previous: the drying, firing, and all connected with the manufacture. The capacity of our flower pot drying-rooms of to-day far exceeds the entire product of any one year prior to 1865. At that time the custom of using wood for drying and firing pots still continued. It required three cords of white pine and from thirty to forty hours' labor to thoroughly fire a small furnace. To-day three tons of bituminous coal will fire five times as much pottery in fifteen hours.

It is a very common saying that one flower pot is as good as another, provided it will hold together long enough to grow the plant. This is equivalent to saying that one rose is as good as another. The late C. M. Hovey has often said to the writer, "Mr. Hews, I want all perfect pots. Suppose I am potting a choice plant which will be worth two or three dollars. I want a good straight pot for it, but I am obliged to pull the pile over before I can find one. When I do find one it is sure to be of such a soft burn that it will hardly hold together." We would then examine some of the choice subjects in his greenhouse, and they were sure to be in warped and cracked pots. "Such a pot spoils the sale of a plant unless I repot it." This was before the day of standard pots. When the Society of American Florists met at Washington in 1892 the writer spent several hours in the greenhouses of the various departments. To say that many of the flower pots looked as if they belonged to that class of pottery found in the Indian mounds of Mexico would be a reflection on the aborigines. The poor preparation of poor materials is a feature of the thousands of inferior flower pots that flood our markets. The practical florists were long ago convinced that the best pots are the cheapest.

1937. Pots of various sizes.

All are "standard" pots except the rimless one at the right, which is a "rose pot."

Grades of clay used in the manufacture of flower pots are almost as numerous as the banks in which they are found, and require many different methods of treatment. To separate the stones from the clay has always been a very perplexing as well as expensive problem. The clay is first plowed by means of a horse and capstan, whereby one horse will do the work of twenty men with picks. This clay is then loaded in dump carts and carried to the mill, where it is shoveled through a disintegrator, which expels the larger stones and crushes the smaller ones. It then falls on an endless belt and is carried to a revolving drier. This is a new western device, where, by the use of crude petroleum for heat, we evaporate from 20 to 25 per cent of moisture from the clay, and while it passes through a direct blaze of white heat there is sufficient moisture all the time to prevent it from burning. (Burning of the clay at this stage would make it worthless.) To demonstrate this point beyond question, paper and dry shavings were passed through with the clay, and they came out without even scorching.

From the drier, the clay goes into large bins, where it must remain 24 hours, so that portions of it which have become too dry and hard may absorb the moisture from that not dry enough. From these bins it is carried to whippers, which beat the clay without further crushing the stone. From the whipper it goes to the revolving screens, and thence to the elevators.

The next process is mixing, or, as we term it, "pugging." This is all done by machinery. From one machine the clay comes out very soft and plastic, to be worked into plaster molds. From the other the clay comes out into hard cubes for the iron molds of the machine. The pot machine and the jigger of to-day each does the work of from six to eight men at the wheel, even at as late a date as 1885.

The difference in cost between a good and a poor pot is very slight, and if the florist will demand and accept nothing but a first-class pot, a standard in quality as well as size will soon be reached. To be standard in quality a pot must be of clay properly prepared, be of uniform firing, and of a smooth surface inside as well as out. It must also be of right porosity, a condition which can be attained by the proper mixture of clay. Moreover, a machine-made pot should have a smooth rim on the inside, so that the man standing at his bench potting thousands of plants per day, as is being done constantly in large establishments, may have some flesh on his thumbs at night. Such a pot must also be able to stand transportation and years of usage if necessary. "Standard" flower pots, such as are now used by American florists, are shown in Figs. 1937.

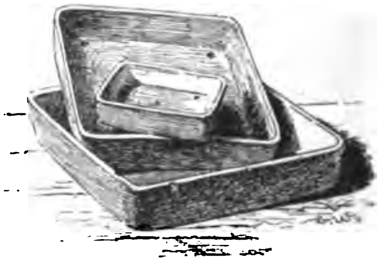
The writer often asks himself, "Will the demand for flower pots in the next quarter century increase in the same ratio as in the past quarter?" In 1869 we manufactured 700,000 pots; in 1894, 7,000,000, or ten times as many after a lapse of 25 years. If the same factory can in 1920, another 25 years later, produce and sell 70,000,000, we shall verily be living in a land of flowers!

A. H. Hews.

POTSHERDS. Gardener's name for broken pots and crocks, a material used in the bottom of pots, pans, boxes, etc., to afford drainage. Coal clinkers, gravel, etc., are often used for the same purpose.

POTTING. The first stage in the life of the plant is when the seedling is transplanted from the seed-bed or the cutting is put in the cutting bench. It is only when either is potted that it can truly be said to take on the dignity of a plant. It is then out of swaddling clothes and enters the ranks of its big brothers and sisters, on the way to making its bow in society; to live perchance in the window of the tenement or on the fire escape; mayhap to refresh the eye of the patient in the sick room; or to lose its identity in rows of its fellows in great glass houses where the blossoms are garnered and sent to market; perhaps to take its place in row upon row of its kind and make an arabesque pattern or gay border, and so delight the eye or regale the senses with sweet odors.

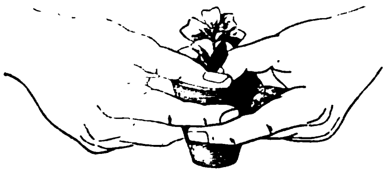
The mechanical operation of potting includes also "shifting," i. e., transferring the plant from a small to a larger pot. Repotting signifies the same, generally speaking, as shifting; but speaking technically it means shaking out an established plant and putting it in a pot of the same size or one smaller, according to its needs. The actual operation of potting is very simple, and yet it must be well done to give the young plant a fair start in life. Careless potting is responsible for many losses in plants. The vast majority of rooted cuttings and seedlings should be potted in 2-inch pots, and it is essential, particularly in the case of rooted cuttings, that it be done at the proper stage of development of the roots. When the roots are from one-eighth to one-fourth of an inch long they may be said to be at their best for potting. If sooner, the plants are not likely to develop as rapidly in the pot as if left in the cutting bench; if later, they are harder to handle, injury is liable to result, and they do not as readily recover from the shock incidental to the change. The



1938. Fern pans.

A form of pottery useful for small bulbs and many shallow-rooted subjects of which spreading masses are desired.

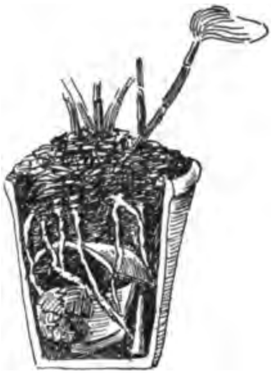
operation of potting as practiced in commercial florists' establishments is as follows: The soil having been prepared, the workman places the empty pots at his left hand, the cuttings in front of him, and an empty "flat" to receive the potted plants at his right. With a simultaneous movement he takes an empty pot in his left hand and a handful of soil in his right. He "sets" the pot in front of him, fills it with soil, and while doing so reaches for the cutting, retaining a small portion of soil in his hand. With the index finger of the right hand he makes a hole in the center of the pot of soil, inserts the cutting, drops the portion of soil which he retained in his right hand into the hole, takes the pot between the index and middle fingers of both hands to steady it and obtain leverage, places his thumbs on each side of the cutting and parallel with his body (Fig. 1939), the right on the side away from his body, the left on the other side, and presses evenly and firmly; then shifts his thumbs so that they are at right angles with his body and presses again; transfers the potted plant with his right hand to the "flat," placing it with a little force to level the loose soil on top, reaching for another empty pot with his left hand as he does this, and repeats the movements. It is marvelous how rapidly these motions are made by expert workmen, and the work can be done as well rapidly as slowly when the cuttings are in the proper condition as to root-development already described. There was a time when 5,000 per day of 10 hours was considered the maximum, and it is still good work for the average workman. James Markey, an employe of the late Peter Henderson, repeatedly potted 10,000 verbena cuttings with two boys to assist in taking away the plants as potted, supplying him with empty pots and cuttings, the requisite quantity of soil having been previously placed on the bench. The writer was his only assistant when he made his first great effort at "breaking the record," when he succeeded in potting 7,500 in 10 hours. Upon one occasion he potted 11,500 verbena cuttings in a day of 10 hours, which is the highest number ever reached. At a potting contest held in Madison Square Garden in New York city in 1892, George Martin potted 1,373 cuttings in one hour, the material used being arborvitæ cuttings without roots.


1939. Potting a cutting.
The moment when the thumbs come into play.

1940. Implement for firming the soil in large pots.

The "standard" pots (Fig. 1937), cannot be handled as rapidly as those without rims, for the reason that the lower edges of the rim are sharp and rough and make the fingers of the workman sore. Consequently the pots without rims are to be preferred. The essentials in good potting are to put the cutting in the center of the pot and at the proper depth, to firm the soil thoroughly and evenly, and to leave one-fourth of an inch, or a little less, between the top of the soil and the upper edge of the pot to receive water.

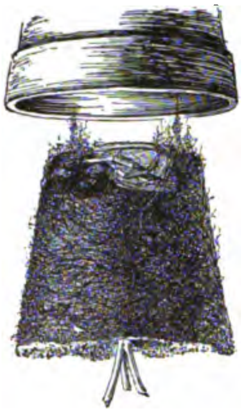
Included in potting is the care of the plants immediately after being potted and until they have taken root in the pots. First in importance is the "setting" of the plants on the bench; care should be taken that they are "set" perfectly level so that they will hold water. They should be watered thoroughly and shaded as soon as they are set. The best method of shading when large quantities are potted is by the use of lath shutters. These are made by nailing common laths on three parallel pieces of furring strip, allowing one inch space between the laths. They may be made any length, three feet being a very convenient size. Inverted pots of a sufficient height to clear the young plants make very handy supports for these shutters. During late spring and summer it will be necessary to supplement this method of shading by covering the shutters with paper or muslin, the muslin being preferred. Sew the muslin in 10-yard lengths, giving pieces 2 yards wide. Sprinkle the muslin copiously at intervals as it becomes dry. This care must be kept up for 3–6 days according to conditions; the shutters should be put over the plants early in the morning, first watering the plants; an hour or so later the muslin should be put on provided the sun is shining brightly. After the second day the period for covering the plants should be shortened by putting shutters and muslin on later and taking them off earlier until the plants are sufficiently established to get along without them. An important detail is to have about half an inch of sand on the bench to retain moisture and allow for the proper "setting" of the plants. Another very important detail, in case new pots are used, is to thoroughly saturate them with water before filling, allowing sufficient time for the water to evaporate from the surface before using. It is bad practice to work with wet pots, and worse still with wet soil. A good test of the proper amount of moisture in soil for potting is when it molds in the hand only under strong pressure. Another essential, in case old pots are used, is to see that they are clean inside at all events; they should be clean outside as well, but if any old soil is found adhering to the inside of the pot it should be cleaned out and thrown away.


1941. Potting an orchid.
The pot is cut in two to show the proper conditions inside.

Potting large plants from the open ground, such as carnations, roses, geraniums, shrubs, etc., is an entirely different operation from the foregoing. These all require pots 5 inches in diameter and over, and sufficient pressure cannot be given with the thumbs to properly firm the soil. It is necessary, therefore, to use a stick about an inch wide, and sharpened down to one-fourth of an inch at the end. (Fig. 1940.) The handle should be round, and in a large place where much heavy potting and shifting are done it pays to have some of these sticks in regular tool stock. After the plant is placed in the pot and the latter filled with soil, take the stem of the plant at the surface between the index fingers and thumbs, the other fingers extended down the sides of the pot, lift the pot about an inch and set it back with a smart shock, at the same time pressing the plant

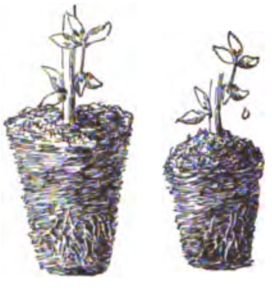
1942. "Shifting" an established plant into a larger pot.

down and steadying it; this settles the soil considerably in the pot. Next take the stick described above and run it around the inside edge of the pot twice or so to pack the soil, add more soil to fill up, finish by pressing evenly and firmly the entire surface with the thumbs, allowing half an inch of space between the surface of the soil and the upper edge of the pots to hold water. What has been said about new and clean pots applies with even greater force to large pots.


1943. A plant may be turned out of its pot to ascertain if it needs a "shift."

The potting of orchids is a radically different operation from the potting of purely terrestrial plants, about which the preceding has been written. Take Cattleyas as an example. Being epiphytes, they do not require soil in which to grow. Put them in as small pots as possible. The material for potting best suited to these and most orchids is fibrous peat and live sphagnum moss in equal proportions, adding a small portion of broken charcoal. If freshly imported pieces are to be potted, cut away all the old, dead roots, pseudobulbs and leaves. If the formation of the piece is uneven it should be cut in two, so as to combine the parts thus separated into a more symmetrical whole, with the growths pointing to the center. Have the pot thoroughly clean, fill it about half with clean "crocks" and small pieces of charcoal, adjust the piece in the center of the pot, distributing evenly any roots which remain; but first spread a layer of moss over the "crocks," then press the preparation of peat and moss evenly and moderately firm around the piece and in the interstices between the roots, finishing up high around the center; insert some small-sized stakes at the proper places to support the piece, tie the growth to them, and the job is finished. Fig. 1941 will show better than words can describe how the plant should look after it is potted.

Repotting, when necessary, is almost identical in its details with potting itself. The spring is the best time to do it, even with species which flower in the fall. Carefully remove all the old crocks and other material, so as not to injure the roots, a pointed stick being the best implement for the purpose. Then replace as carefully with new material in a clean pot. The undersigned dwells upon cleanliness repeatedly, for herein lies the great essential in successful plant-growing. Potting orchids in baskets, which sounds paradoxical, is identical with potting them in pots as far as the essential details of manipulation are concerned. The potting of bulbs is discussed under *Bulb*.

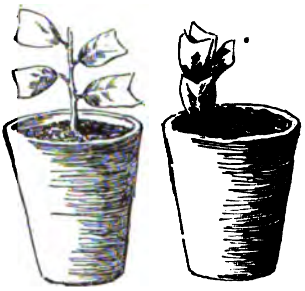

1944. Repotting a sickly plant.

The "shoulder" is rubbed off as at *b*, replaced by fresh soil and the whole ball of earth reduced in size. (Only a fraction of the plant's height is shown.)

"Shifting" is the technical term used in the florist's trade when plants are transferred to larger pots. See Fig. 1942. When the plant exhausts the soil in the small pot it must be put in a larger one to maintain growth. The trained eye detects at a glance by the appearance of the plant when it requires a "shift." Those lacking such training can discover it by turning the plant out of the pot and examining the roots. (See Fig. 1943.) If the outside of the ball of soil on the lower portion is well netted with roots as in Fig. 1943, and particularly if most of them have lost the fresh creamy white color of healthy "working" roots, then the plant must be at once shifted, or it will soon reach that stage which is the bane of the careless plant-grower; viz., "potbound."

"Knocking out" is the technical term used by florists to describe the turning of a plant out of a pot. The best way to do this is to take the pot in the right hand, invert it in passing it to the left, as the plant should be placed between the index and middle fingers of the left hand, give the pot a smart tap on its rim on the edge of the bench and the ball of soil is separated from the pot; place the plant in a flat ready for the purpose, and repeat. One tap is all that is necessary in ninety-nine cases out of a hundred. It is bad practice to get into the habit of giving a series of taps, as it makes slow work. We are considering now the first shift, i. e., from a 2-inch to a 3-inch pot.

The plants having been knocked out, the next operation is to "shoulder" them. This consists of removing the shoulder or edge of the ball of soil with the thumb and forefinger down to where the roots begin. Fig. 1944. The object of this is obvious, to remove leached-out soil and supply a fresh, nutritious portion in its place, so as to get the greatest possible advantage from shifting. Everything being made ready, the operator proceeds by putting a portion of soil in the bottom of the pot sufficient to raise the ball of soil flush with the edge of the pot. As this is being done, reach for the plant with the left hand and put it in the center of the pot; simultaneously take a handful of soil in the right hand and fill the pot, then grasp the pot between the index and middle fingers of each hand, place the thumbs on each side of the plant at right angles with the body, lift the pot about a half-inch and set it back on the bench with a smart rap, pressing with the thumbs at the same time; change the thumbs to right angles with their former position and press again, then change so as to press where they have not touched already; three pressures of the thumbs and the rap on the bench, and the operation is done. A smart operator with two boys will shift 5,000 plants in 10 hours. This amount of work is made possible only by eliminating all unnecessary motions and making them synchronous with each hand in reaching for soil, pot and plant as described. One hand should not be idle while the other is employed. See Figs. 1945–9 for good and bad examples of potting.


1945. Good and bad potting.

The cutting should be placed in the center.

Be careful in shifting not to set the plants too deep. The tendency of roots is downward, and only enough of the stem to steady the plant in the pot should be in the soil. Plants set too deeply in the pots are easily overwatered, because so much soil is not within the influence of root action. A few plants which root from the crown, like lilies, should be set deeper than such plants as roses, geraniums, fuchsias, palms and all plants whose root action is mainly downward.

Do not give too great a shift at one time; that is, do not attempt to shift from a 2-inch pot to a 5- or 6-inch. As a rule, an inch at a time is best, especially for commercial purposes, where plants are grown to be shipped some distance. In private places soft-wooded plants may be shifted in spring from 2- to 4-inch pots and from 4- to 6-inch, as the question of shipping does not enter. But it would not be safe even with these to do the same in late fall when growth is slower and the days are growing shorter. Hard-wooded plants, such as palms, azaleas, etc., and even roses should never be shifted more than an inch at a time; in fact, it is better not to shift them later than September in any case. The spring is the best time to do it.

Drainage is necessary in all pots over 4-inch and for hard-wooded plants even that size is better drained. This is technically called "crocking," i. e., placing potsherds in the bottom of the pot to allow the quick passage of water and admit air to the roots. Place a large piece over the hole in the bottom of the pot and the remainder in smaller pieces. There are usually enough broken pots around a place to supply the needs. Charcoal is an excellent material for supplying pot drainage, none better. An inch or so of drainage is sufficient in a 5- or 6-inch pot, two inches or so for all sizes above these. A bottom of broken stone, cinders or gravel is essential upon which to stand the pots, as such a stratum accelerates drainage, while at the same time providing a moist surface so beneficial to plants in a greenhouse.

A few words of caution may not be out of place before closing this branch of the subject. Never shift plants while the ball of soil is wet; it should be dry enough to crumble readily to the touch. Never shift into dirty pots: it will pay to clean them, especially the inside. Never shift a pot-bound plant without loosening the soil on the surface of the ball. A few smart raps with the closed fist will do it; or better still repot as now described.

Repotting is necessary frequently when plants have become pot-bound, or when from any cause they appear to require it; such, for instance, as debility from over-shifting, over-watering or neglect of any kind. In such cases the soil should be washed from the roots almost entirely and the plant put into a pot a size or two smaller than it has been growing in, taking care to firm the soil well, and if a shrubby plant prune it back according to its needs and condition. Shade such plants until danger of wilting is past and water sparingly until new and vigorous growths appear, showing that the subjects have regained their normal health.

There are a few cultural details intimately associated with potting which may with profit be added as a closing paragraph. The high, narrow pot shown on the extreme right of the line of pots in Fig. 1937 is frequently used for roses and palms by some, especially for *Cocos Weddelliana*, which makes a long tap-root and which it is almost invariably fatal to break. It is feasible, however, to avoid this if the seeds are sown in 6-inch pots, using 4 inches of clinkers as a bottom. These check the downward growth and induce development of fibrous roots in the soil, so that the tap-root may be cut off below them and the ordinary 2-inch pot used with safety. It is not necessary to use the deep pot for roses in any case. Plants which exceed the diameter of the pot should be given room to allow for development. The best market growers plunge the pots in soil to half their depth, as it is necessary in the spring months because of the rapid evaporation of water. This refers especially to geraniums, fuchsias, heliotropes, petunias, etc. Care must be taken, however, to lift them occasionally so as to prevent the roots from getting hold in the soil through the hole in the bottom of the pot. Ten inches apart from center to center for such plants will not be too much if stocky plants well set with good flowers are wanted; and in these days such plants will bring enough in the best markets to pay for the space and trouble. For 2- and 3-inch pots use sifted soil, but for 4-inch and over soil well broken, but having plenty of fiber from sod in it, should be used. Always water plants thoroughly after shifting so as to soak the soil to the bottom, and do not water again until they show dryness half way down the pot on the outside.

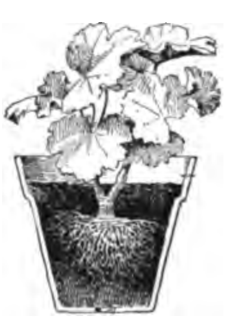
Patrick O'Mara.

POURRETIA. See *Puya.*

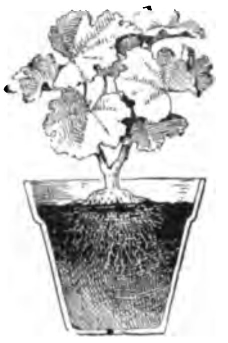
POURTHIÆA villosa. See *Photinia.*

PRAIRIE CLOVER. *Petalostemon.*

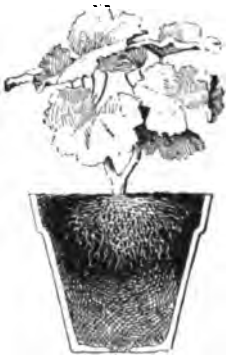
PRAIRIE DOCK. *Silphium terebinthinaceum.*



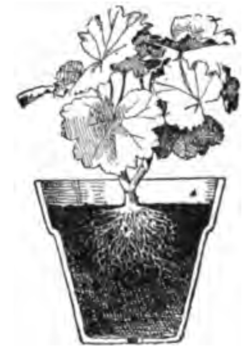
1946. Too deep.



1947. Too high.



1948. Pot too full.



1949. Good.

PRENÁNTHES (Greek words, meaning *drooping blossom*). *Compósitæ.* Rattlesnake Root. A genus of about 16 species of tall perennial herbs, of which 10 are natives of North America. A few species are offered by collectors. Prenanthes are leafy-stemmed plants with dull colored heads borne in spike-like terminal panicles. Lvs. alternate, lower ones petiolate, sagittate, cordate, often much divided: upper ones auriculate and much narrower and smaller heads: 5–30-fld.: akenes terete, 4–5-angled, usually striate. The species are extremely variable. They are of easy culture in any good soil.

A. *Involucre glabrous.*

B. *Heads 5–7-fld.: involucre very narrow, only 1 line thick.*

altíssima, Linn. A variable species. Stem 3–7 ft., slender: fls. greenish yellow; pappus straw-colored or whitish. July–Oct. In open or shade, Canada to Ga. and Tenn.

BB. *Heads 8–16-fld.: involucre broader, 1½–3 lines thick.*

C. *Pappus deep cinnamon-brown.*

álba, Linn. Stem 2–5 ft. high, usually purplish: inflorescence thyrsoid-paniculate: fls. dull white. Aug., Sept. Open woods and sandy soil, Canada to Ga. and Ill. B.B. 3:289. Mn. 3:161.

CC. *Pappus straw-colored.*

serpentària, Pursh (*Nábalus Frâzeri,* DC.). Stem usually about 2–4 ft. high, sometimes purple spotted: fls. purplish, greenish white or yellowish. July–Oct. Ont. to Fla. and Ky. B.B. 3:289.

AA. *Involucre hirsute-pubescent.*

racemòsa, Michx. Stem 6 in. to 2 ft. high: stem-lvs. mainly sessile, while they are mostly petiolate in the other species here described: fls. purplish. Aug., Sept. Moist open places, Canada to N. J. and Colo. B.B. 3:291.

F. W. Barclay.

PRESTÒNIA (probably named after Charles Preston, a correspondent of Ray). *Apocynàceæ.* About 30 species of tall climbers from tropical America. *P. venosa* is a tender foliage plant once offered in America as *Echites nutans.* Prestonia differs from Echites in having a callous ring inside the corolla-tube at the throat and often 5 linear, erect scales below. Other generic characters: calyx with 5 entire or lacerated scales inside at the base: corolla salver-shaped, the tube constricted at the throat; lobes 5: ovary with 2 distinct carpels; seeds comose at the apex.

The following points are adapted from Lowe's Beautiful Leaved Plants: *P. venosa* is cultivated for the network of crimson veins on its foliage. The plant blooms rarely, and its fls. are far inferior to Echites or Dipladenia. When properly cultivated it makes a charming subject, but if neglected it is as worthless as a weed. It can hardly be propagated by cuttings; the fleshy roots are cut into pieces 1–2 in. long. The plant demands a temperature of 85° F., with an atmosphere as moist as possible. Foliage should never be syringed. Young plants should be raised every season, as older plants become unsightly. The plant was formerly considerably grown, being trained to a balloon-shaped wire trellis. Needs warmth to bring out the markings.

venòsa, Mottet (*Echìtes nùtans*, Anders. *Hæmadictyon venòsum*, Lindl.). Lvs. opposite, ovate-lanceolate, villous beneath: fls. yellow, in pedunculate panicles: corolla-lobes roundish, wavy. St. Vincent in the West Indies. B.M. 2473. Lowe 58.
W. M.

PRICKLY ASH, *Xanthoxylum.* **P. Comfrey,** *Symphytum asperrimum.* **P. Pear,** *Opuntia.* **P. Poppy,** *Argemone.*

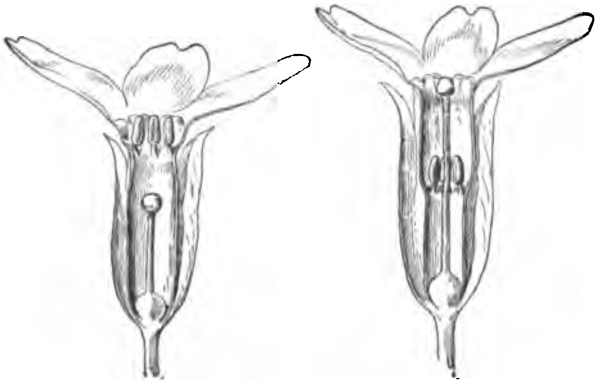
PRIDE OF INDIA. *Melia Azederach.*

PRIM. See *Ligustrum.*

PRIMROSE. *Primula.* **Arabian P.** is *Arnebia cornuta.* **Cape P.** is *Streptocarpus.* **Common P.** is *Primula vulgaris.* **English P.** is *Primula vulgaris.* **Evening P.** See *Œnothera.*

PRIMROSE PEERLESS. *Narcissus biflorus.*

PRÌMULA (*Primula veris*, the "first in spring," was an old appellation of one or more of the species). *Primulàceæ.* PRIMROSE. Low herbs, mostly spring-blooming, with monopetalous salverform fls. in clusters on scapes that arise from a radical cluster of leaves, the fls. usually showy (pink, lilac, purple, yellow, white), with a tube usually surpassing the 5-toothed or 5-cleft calyx; corolla with 5 spreading lobes, which are usually notched or retuse at the end and more or less narrowed at the base; stamens 5, affixed to the corolla-tube: ovary 1-loculed, with many ovules on an axile placenta, and 1 undivided filiform style and a capitate stigma. The flowers of some Primulas are strongly dimorphic or trimorphic,—the stamens and pistils of different lengths in different flowers of the same species. Fig. 1950. See Darwin's work, "The Different Forms of Flowers on Plants of the Same Species." This polymorphism is associated with cross-pollination. Primulas are natives to the north temperate zone, only one being known in the cold parts of southern South America, and one in Java. They are mostly boreal or alpine plants. About a dozen are native to the colder parts of North America. The greatest extension of the alpine section occurs in the Himalaya region, in which there are more than 40 species. There are several showy Chinese species, some of which are now in general cultivation. The total number of species is usually placed at 80–100, but Pax, the latest monographer (Monographische Übersicht Über die Arten der Gattung Primula, Leipzig, 1888, and in Engler's Bot. Jahrbücher vol. 10), admits 145 species.



1950. Polyanthus flowers, to show dimorphism.

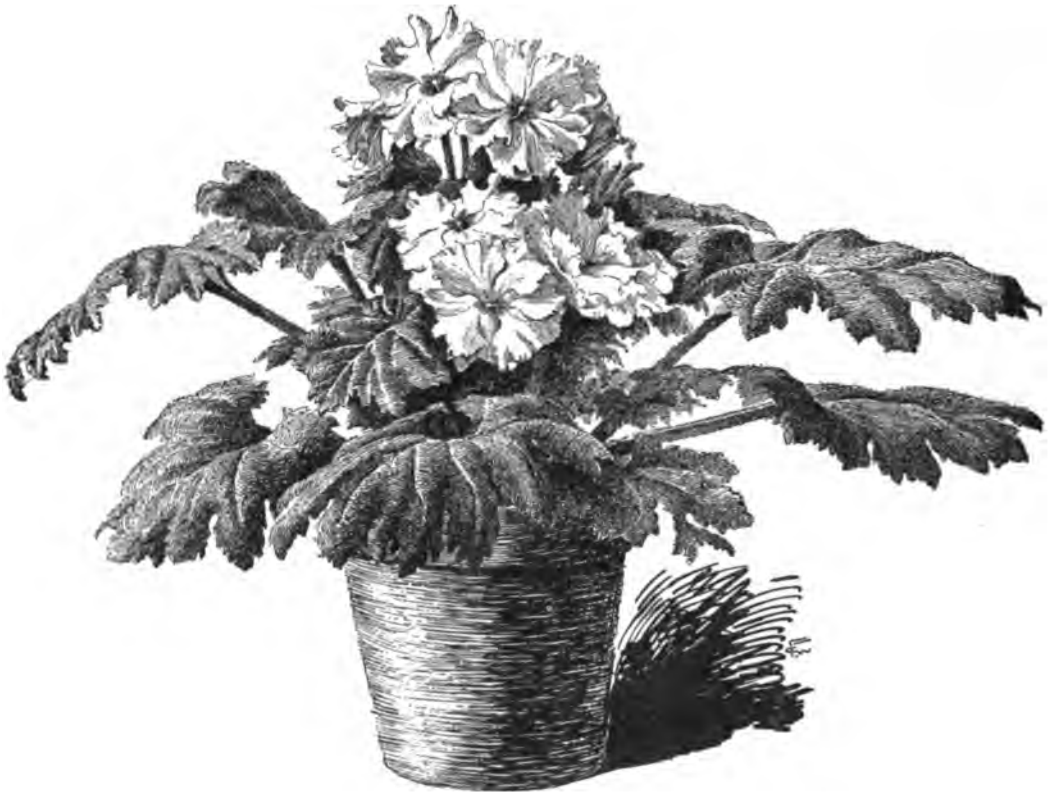
The outdoor Primulas should be protected from the midday sun. Give a covering of mulch in winter. They are amongst the finest of all hardy plants. Primulas are mostly perennial. Several cultural groups may be recognized: (1) The alpine section affords some of the most useful plants for rock and alpine gardens. The relatively little attention given to alpine gardens in this country is the reason for the neglect of these charming spring-flowering plants. (2) The polyanthus class, comprising fully hardy spring-flowering plants, suitable for culture under ordinary garden conditions, and always popular in this country. To the same class belong the true cowslip (*P. officinalis*) and the oxlip (*P. elatior*), but these are rarely seen in our gardens in their pure form. All are easily propagated by division. (3) Yellow-flowered or purple-flowered verticillate-clustered outdoor species, of the *P. imperialis* and *P. Japonica* type, some of which are hardy even in the northern states with some winter protection. (4) The true greenhouse species, represented by the old *P. Sinensis* (Chinese Primrose), the more recent *P. obconica* and the still more recent *P. Forbesi.* These are Chinese species. The colors are of the cyanic series. (5) The auriculas of gardens, developed from *P. Auricula.* In the auricula and cowslip groups hybrids are many, but elsewhere in the genus good hybrids seem to be few.

The hardy Primulas are usually treated as alpine or rockwork plants, to which their small stature, tufted habit, and love of cool partially shaded places admirably suit them. The reader who wants a long list of the species that are suited to alpine and rock gardens should consult Correvon's "Les Plantes Alpines et de Rocailles," Paris, 1895. For the present purpose, the writer selects a list of twelve species recommended by Selfe-Leonard for alpine gardens in England (Journ. Royal Hort. 19, p. 52 (1895): 1. "The golden yellow *P. Auricula*, which has the additional interest that it is certainly one of the original parents of our florists' Auriculas."—2. "That loveliest of white alpine Primulas, *P. viscosa*, var. *nivalis*, not to be confounded with the rarely seen *P. nivalis* of the Himalayas." *P. viscosa*, All., is a variable species with rosettes of obovate or nearly orbicular lvs. that are toothed above, and short scapes bearing umbels of mostly purple or rose fls., with corolla-lobes deeply 2-lobed. Eu.—3. *P. rosea* and its vars. *grandiflora* and *splendens* (see No. 21).—4. "If you want a large and robust alpine species with crimson flowers to match with *P. viscosa*, var. *nivalis*, take *P. viscosa*, var. *major*" (=*P. Peyritschii*, Stein, but it is a hybrid of *P. Auricula* and *P. viscosa*).—5–9. "So great is the number of fine forms and hybrids of this well-known *P. viscosa* that the next five of my items must be taken from their ranks, viz.: *P. ciliata* (of gardens), with a good blue-purple flower; *P. ciliata*, var. *purpurata*, a brilliant red or crimson-purple: *P. Balfouri*, a beautiful Scotch hybrid of a rare tone of color; *P. Lindsayana*, a scarce and fine hybrid from the same northern gardens, I think; and *P. ciliata*, var. *coccinea*, of a rare red shade."—10. *P. spectabilis*, Tratt., *P. Wulfeniana*, Schott, or *P. Clusiana*, Tausch., all from the Alps. These are considered to be forms of one species by some writers, but Pax keeps them distinct. They are all members of the Auricula group.—11. *P. glaucescens*, Mor. (*P. calycina*, Duby), one of the Auricula group. Alps.—12. "That perhaps most satisfactory of all, for either open-air rockery or frame, the charming *P. marginata*, Curt., of the Maritime Alps." It is a compact plant with oblong or oval deeply dentate white-margined lvs. and purplish fls. B.M. 191. L.B.C. 3:270.

For horticultural accounts of Primulas, see Journ. Royal Hort. Soc. 1886, 1891 and 1895; Himalayan Primroses, Gn. 16, pp. 534–535 (W. Munro); Indian Primroses, Gn. 41, pp. 580–582; Hardy Primulas, Gn. 50, pp. 372–376 (F. W. Meyer); Primroses and their allies, G. C. III. 27, p. 325, et seq. (R. Lindsay). For Mexican Primrose, see *Œnothera*.

L. H. B.

The genus Primula contains many charming and beautiful species; they not only brighten our gardens in spring and summer, but all through the winter we can enjoy the blossoms of many showy species in our greenhouses. There are many species that can not be grown in the North, owing to the cold winters and dry, hot summers with which we have to contend. Nevertheless, with some care a large number of choice species can be grown. There are some which grow luxuriantly out of doors; others can be grown in coldframes with a northern aspect; and a large number are some of our showiest greenhouse plants for winter decoration.



1951. Primula Sinensis (× ⅓). **A young plant, as the flowers are beginning to appear.**

The species of Primula are generally raised from seed, but varieties which do not come true from seed are increased either by division or cuttings. The seeds of hardy Primroses should be sown soon after they are collected, as their vitality is impaired if they get too dry.

The European Primrose, *Primula vulgaris*, with many of its garden forms, thrives admirably in a moist, deep, light soil, with partial shade, and a slight protection of dry leaves or meadow hay in winter. It is easily raised from seed. A good strain is important, if some of the very best varieties are to be obtained. The cowslip, *P. officinalis*, and the oxlip, *P. elatior*, grow under the same conditions as the above. The polyanthus has been in cultivation for many years, yet its origin is involved in obscurity, although some think it is a cross between the primrose and the cowslip. It is a favorite garden plant and deserves to be so. Its flowers have charmingly rich colors. They are most generally used as spring bedding plants. When used in this way they ought to be planted in beds where they are partially shaded during the hottest part of the day and a liberal supply of water given to them, as they are very impatient of drought. When they are through blossoming they may be removed from the beds, to make room for summer bedding plants, to some moist shady place where they can remain until fall. They are then divided and planted in coldframes for the winter. In spring they are transplanted from there to the beds again. In sheltered parts of the rock garden they can be grown successfully. They take kindly to pot culture, and many of them are grown in this way to decorate conservatories in spring. Of late years the Primrose and polyanthus have been forced in spring by florists for cut-flowers, those with fine yellow blossoms being most in demand. The polyanthus can be raised from seed, but some of the fine varieties are best propagated by division.

The common auricula, *P. Auricula*, is best grown in pots in a cool greenhouse or in coldframes. In a protected corner under the shade of some hemlocks at the Harvard Botanic Garden, there has been a good clump of this plant growing and blossoming annually for the past ten years. See *Auricula*, vol. I.

P. auriculata, a pretty little Asia Minor species, can be grown in a warm sheltered position. *P. cortusoides* blossoms very early in spring, and requires slight protection and a warm position. There are many varieties of this plant. *P. farinosa* is a beautiful native plant requiring a stiff loam and a damp situation with shade during the warmest part of the day. *P. denticulata* comes from the Himalayan Mountains and is quite hardy in the rock garden, grown in a moist, deep, rich, loamy soil. There are many varieties of this species, but the handsomest is *P. denticulata*, var. *Cachemiriana*. The form with white flowers is also pretty. Care should be taken that this species and its varieties are planted in a slightly elevated position where water will not settle around the plants in winter. If grown in a low, damp position, the crowns are liable to rot in winter. In a warm sheltered position in the rock garden *P. capitata* may be grown, but must be well sheltered from the hot summer sun. *P. Japonica* is a splendid hardy plant and grows vigorously in a rich, deep, moist soil. When the plants become established they self-sow themselves. It also makes a good plant to force in pots in the spring. The seed of this plant ought to be sown as soon as ripe; if this is not done they never come so evenly, and also require a long time to germinate. The native *Primula Mistassinica* is a charming dwarf Primrose; to be successful with it the requirements are a very damp place and not too much shade. *P. rosea*, a Himalayan species with good qualities, can be grown in a sheltered place, but must be given a covering of dried leaves in the winter. *P. Sieboldii* is a distinct Japanese plant and is an exceedingly showy Primrose when grown under proper conditions. There are many named varieties of this plant, the best being Lilacina, Magenta Queen, Rosea alba, Rosea striata and Violacea. A light soil well enriched with decayed leaf-mold, a sheltered position with partial shade and a covering of dried leaves in the winter are the requirements necessary for success with this Primrose and its varieties. This plant makes an excellent pot-plant and is easy to force in spring.

There are a number of species of Primula that are grown in the greenhouse, but the most popular is *P. Sinensis*. By selection and crossing there are many improved varieties from the pale pink plant that was introduced in 1820. Every shade of color from pure white to deep crimson and even deep blue is obtained in the flowers and also great variety in form and doubleness. Not only has the flower been improved, but there is a great variety to be had in foliage. The double forms are increased by cuttings; semi-doubles are raised from seed. The named varieties are raised from seed sown annually and they come true to color. There are several strains of seed which receive separate names, but to get a good strain is important. It requires as much time and labor to raise plants from a poor strain as from a good one. The good strain costs a little more to begin with, but the superior quality of the blossoms and plants pays in the end. The first week in April is a good time to sow the seed in order to get plants to flower early the following winter, and about the middle of May for a second batch to succeed the first sowing. Sow the seeds in well-drained shallow pans. Use finely sifted leaf-mold, loam and sand in equal parts. Cover the seeds lightly and place the pans when well watered in a temperature of about 60° Fahr. Sometimes the seed does not germinate evenly; the best thing to do then is to prick off all the young plants into fresh soil similar to the above. Shake a little fresh soil over the seed-pan again and place it in the same temperature, and very soon the remainder of the seed will germinate. When the young plants have three or four leaves they may be potted off singly into 3-inch pots, using a compost slightly rougher than the one used in the seed-pans. When the small pots are filled with roots the plants may be shifted into larger ones, the final shift being into 6-inch pots, using a compost of good fibrous loam, rotten cow manure, leaf-mold and sand. When given the final potting care should be taken that the base of the plant rests on the soil, but it should not be buried. If the plant is not potted right it will be loose at the crown. When this is the case the only remedy is to place three small stakes in a triangle round the crown; this helps to keep the plant steady when top-heavy with blossoms and foliage. When the pots are full of roots, weak liquid manure made from fresh cow manure may be given once a week. During the summer they require shade and should be grown in a cool greenhouse or frame, where they ought to have plenty of air at all times. In winter a temperature of 45° F. suits them well, and they last much longer in blossom than if kept warmer. This Primrose is seldom troubled with insect pests. Some of the best and most distinct varieties are Russell's Queen of Whites, Alba magnifica, Princess Louise, Cheswick Red Improved, Comet, Rubra superbissima. The best blue out of a number we have tried is Farquhar's Improved Blue. The semi-doubles can be had in good distinct colors, but the old double white is the best double Chinese Primrose and should be more grown than it is at present.

1952. Single and semi-double Chinese Primroses. Natural size.

1953. Primula obconica (× ½).

Sutton's *Primula stellata* is without doubt one of the finest and most graceful Primroses we have for greenhouse or conservatory decorations. The form with white flowers is the most pleasing; but the red and pink shades are also attractive. The foliage is like that of *P. Sinensis*, but the flowers are far more graceful and produced in whorls on long, erect stems. This plant will blossom from November to May. It requires the same treatment as the Chinese Primrose, only the seeds can be sown a little earlier.

Primula floribunda is a charming winter-flowering greenhouse plant from western Himalayas. Its yellow flowers are produced on stems from four to six inches long. There is an improved form which has larger blossoms than the type. This plant is easily raised from seed. *Primula Forbesi* comes from China. It is a dwarf, compact plant, and its lilac flowers are produced in whorls on long, wiry stems, as they are in *P. Japonica*. It can be raised from seed or increased by division. *P. obconica* is a very showy plant and will produce blossoms almost continually. It would make a valuable florists' plant if it was not that it is slightly poisonous to the touch. It has been greatly improved since its introduction in 1882. The best form now in cultivation is *P. obconica*, var. *grandiflora fimbriata*. Young plants are easily obtained from seed and can be grown in the greenhouse in one summer until they are large enough for 8-inch pots. *Primula verticillata* is a desirable greenhouse plant with yellow flowers which are produced in whorls on the stems. It has handsome foliage covered with a white mealy powder. If this powder is washed off with careless watering the plants are never so handsome. ROBERT CAMERON.

Running Notes on Primula.—Of the greenhouse species, *P. Sinensis* is the old stand-by. The single forms are easily grown from seed. It requires about seven months from date of sowing to bloom. For fall flowering, sow in March. Soak seeds 24 hours in water. This will insure a more even germination. Then sow in pans filled with light sandy soil, covering the seeds only very thinly with sand; temperature 70° F. Keep pans always moist and shady. In two or three weeks' time, in case seeds were fresh, which is most essential, the young seedlings need pricking out. For that purpose flat boxes or earthen pans filled with a mixture of two parts peat and one part common garden soil are the best; do not take pots, because they are too deep and do not dry out fast enough. Keep shady; temperature 70°. When large enough, transplant in thumb-pots very loosely and not too deep. Mixture of soil and the temperature should be the same as previously advised. Keep plants shifted into larger pots as fast as they require it. Do not let them get root-bound. Make the soil heavier at each transplanting. At the last shift, which should be from five to six months from date of sowing, use liberally of cow manure and bone-meal. Through the whole summer plants should be kept shady and cool, syringing overhead twice a day. Get them accustomed to the sun in fall. Temperature in winter 50° to 60° F. Double Primulas can be propagated by cuttings in moss at a temperature of 70° to 80° F. After they are rooted, treat them the same as seedlings. The best time for propagating is in February and March. We need hybrids of this Chinese Primrose with other greenhouse species. The writer has succeeded in making a promising cross of *P. Sinensis* and *P. obconica*. This is figured in American Agriculturist, March, 1900.

Primula obconica and the form known as *P. obconica hybrida* should have treatment exactly as for *P. Sinensis*. *P. Forbesi* is a small lilac-flowered greenhouse species, requiring the treatment given *P. Sinensis*. It is now becoming well known.

Primula Auricula, the Primrose of the Alps, has flowers variously colored, mostly yellow. Hardy or half-hardy, needs light soil, plenty of air and sunshine; good for rockwork. The Auricula has never become popular in America.

Primula cortusoides and *P. Sieboldi* are beautiful species of Siberia, of dark rose color. Hardy; give plenty of air and a very sunny, rather dry exposure. Very satisfactory spring flowers.

Primula capitata has flowers violet-blue in dense heads. It is one of the most beautiful species of the Himalayan region. It is difficult to cultivate here, because it needs a very cool temperature. Sow seed in coldframe, prick out as soon as up, keep on growing outside in a cool place through the summer. In fall they may be potted, and, kept in the coldframe through winter; they will be beautiful pot-plants in spring. It is a good plant for rockeries if it gets a place which is sheltered from the sun and yet not shady. *P. denticulata* and var. *Cachemiriana* are hardy. Give a moist, sunny place.

Primula Stuartii has dark yellow flowers. This beautiful species is half-hardy; it needs a light soil, but not dry, with full sun. Covered with a box over winter, it will come through safely. It is rarely seen in this country. ADOLF JAENICKE.

INDEX.

acaulis, 15.
alba, 17.
amœna, 10.
Auricula, 1.
auriculata, 20.
Boveana, 3.
Cachemiriana, 17.
capitata, 18.
Cashemiriana, 17.
caulescens, 15.
Chinensis, 7.
cortusoides, 9.
Courti, 3.
Cowslip, 13.
Cusickiana, 25.
denticulata, 17.
elatior, 14.
erosa, 19.
farinosa, 22.
filicifolia, 7.
fimbriata, 7, 8.
floribunda, 2.
Forbesi, 11.
grandiflora, 8, 10. 21.
imperialis, 5.
Japonica, 6.
Kashmiriana, 24.
longifolia, 20.
Mistassinica, 23.
obconica, 8.
officinalis, 13.
Oxlip, 14.
poculiformis, 8.
Polyantha, 16.
prænitens. 7.
prolifera, 4.
pulcherrima, 17.
purpurea, 17.
pusilla, 23.
rosea, 8, 21.
Rusbyi, 26.
Sibirica, 24.
Sieboldi, 10.
Simensis, 3.
Sinensis, 7.
stellata, 7.
Stuartii, 27.
variabilis, 16.
verticillata. 3.
vinciflora, 12.
vulgaris, 15.

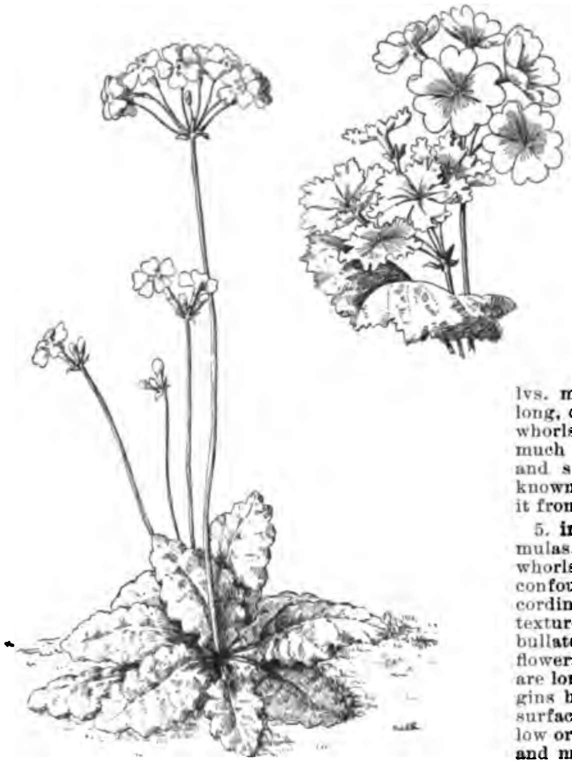
KEY TO THE GROUPS.

A. *Young leaves involute (rolled inwards or upwards).*
  B. *Lvs. thick: fls. umbellate: involucral bracts usually not leafy.* 1. AURICULA
  BB. *Lvs. thin: fls. verticillate: bracts leafy*.......... 2. FLORIBUNDÆ
AA. *Young lvs. revolute (rolled backwards).*
  B. *Plant large, with yellow or purple fls. in successive whorls* .. 3. PROLIFERÆ
  BB. *Plant with fls. in umbels or heads, or if in whorls the plants small and slender (as grown under glass) and the fls. lilac to white.*
    C. *Lvs. lobed, the lobes dentate or crenate*.......... 4. SINENSES
    CC. *Lvs. not lobed, or only indistinctly so.*
      D. *Calyx enlarging after flowering, leafy*.......... 5. MONOCARPICÆ
      DD. *Calyx not enlarging.*
        E. *Fls. not bracted*.......... 6. BARBATÆ
        EE. *Fls. bracted, either solitary or many.*
          F. *Foliage distinctly pilose or pubescent.*
            G. *Each flower distinctly stalked*.... 7. VERNALES
            GG. *Each flower sessile or very nearly so.* 8. CAPITATÆ
          FF. *Foliage glabrous or only minutely pubescent.*
            G. *Involucral bracts gibbous or eared at the base.*
              H. *Capsule globose, included in the calyx* .... 9. AURICULATÆ
              HH. *Capsule oblong-cylindrical, exserted*.......... 10. FARINOSÆ
            GG. *Involucral bracts not gibbose nor eared: capsule cylindrical: petiole narrowly winged*.......... 11. NIVALES

1. AURICULA.

1. **Auricula**, Linn. AURICULA. See p. 118 and Fig. 171, Vol. I. Low, with a radical rosette of thick obovate-cuneate glabrous or pubescent mealy lvs. 2 or 3 inches long, which are often crenate on the upper part: scales 3–6 in. long, erect, prominently exceeding the lvs.: fls. in an umbel, sometimes as many as 20, bright yellow and fragrant, short-stalked, subtended by minute oval mealy bracts, the segments obovate-cuneate and emarginate: stamens dimorphous.—This description represents the wild form as understood and described by J. G. Baker in B.M. 6837. "It is one of the most widely spread of all the species," Baker writes, "as it extends in a wild state from Dauphine and the Jura on the west through

Switzerland to Lombardy, the Tyrol, Hungary and Transylvania." In cultivation, the plant has run into flowers of many colors. It is possible that some of these forms are hybrid progeny with related species. Baker writes: "What the relation is of this widely-spread wild type to the multiform races of the garden Auricula is a subject that still remains to be fully worked out." Pax mentions various natural hybrids.



1954. Primula cortusoides (separate fls. × ½).

2. FLORIBUNDÆ.

2. **floribúnda**, Wall. Hairy: lvs. rather thin, 3–6 in. long, ovate or elliptic or obovate, with a broad petiole, strongly nerved and reticulated, the margins coarse-toothed: scales slender but erect, 10 in. or less, bearing loose whorls that are subtended by three or four leaf-like toothed bracts: fls. small, golden yellow, the slender tube exserted beyond the deep-cleft calyx, the segments obcordate and entire. Himalaya. B.M. 6712, where Hooker remarks: "The plant here figured is found at lower elevations in the Himalayas than any other of the numerous species that inhabit that rich region, occurring between 2,500 and 6,500 ft. along the whole division of the range which extends from Kumaon to Kashmir." Also in Afghanistan. B.M. 6712. Gn. 41:863. G.C. III. 27:195. R.H. 1895, p. 400–1. Gt. 45:1424; 47, p. 221.

3. **verticillàta**, Forsk. Plant growing about 1 ft., bearing yellow fls. in leafy whorls: lvs. lanceolate or oblong-lanceolate: bracts 1-nerved: calyx broadly campanulate, deeply 5-parted, the segments linear and entire: corolla-tube about 5 times longer than calyx, the segments oblong and obtuse and emarginate and the base scarcely contracted. Arabia.—Probably not in cultivation, the plant known under this name in gardens being the following:

Var. **Boveàna**, Mast. (*P. Boveàna*, Decne. *P. verticillàta*, Hort.). Lvs. broadly spatulate: bracts 3-nerved: calyx cylindrical-campanulate, with 5 deep dentate lobes or divisions: corolla-tube 2–3 times exceeding the calyx, the segments rounded and crenulate, contracted at the base, and sometimes bearing a dark spot in the center. Mt. Sinai, etc. B.M. 2842.—An interesting plant with slender-tubed light yellow fls. about ¾ in. long, borne on slender pedicels in a whorl of sharp-toothed bract-lvs., the whorls 2 or 3 and standing well above the rosette of sharp-toothed root-lvs.

Var. **Siménsis**, Mast. (*P. Siménsis*, Hochst. *P. Courti*, Hort.). ABYSSINIAN PRIMROSE. Taller and stouter, growing 18 or 20 in. tall, with root-lvs. nearly 1 ft. long: root-lvs. oblong-lanceolate, mealy: lower bracts oblong and 3-nerved, the upper ones smaller and 1-nerved: calyx broadly campanulate, the lobes deltoid-lanceolate and entire: corolla-tube, 3–4 times longer than the calyx and more or less mealy, the 5 segments obovate and entire, emarginate at the end, contracted at the base. Abyssinia. B.M. 6042 (as *P. verticillata*, var. *Sinensis*).—A striking plant, with large salverform yellow fls., the corolla-tube nearly 2 in. long. Whorls 2 or 3, many-fld. Not to be confounded with *P. Sinensis* (No. 7), a wholly different plant.

3. PROLIFERÆ.

A. *Flouers yellow.*

4. **prolifera**, Wall. Stout, striking species with scape often 18 in. high: plant green, not mealy: lvs. many, long-oblanceolate, often more than 1 ft. long, obtuse, entire or finely toothed: fls. in successive whorls on the slender erect scape, pale yellow, the tube much exceeding the short-toothed calyx, the lobes flat and shallowly obcordate. Bengal. B. M. 6732.—Not known to be in cult., but inserted here to distinguish it from *P. imperialis*, with which it was once confused.

5. **imperiàlis**, Jungh. The noblest of cultivated Primulas, the scape rising 3½ ft., and bearing five or six whorls of deep yellow flowers of firm substance.—Once confounded with *P. prolifera*, from which it differs, according to Hooker, in "the more robust habit, the thicker texture, broader midrib, close reticulate nervation, and bullate surface of the foliage and its deeper colored flowers." The leaves are sometimes 1½ ft. long; they are long-oblong-oblanceolate in outline, obtuse, the margins beset with many small very sharp teeth, and the surface much blistered and reticulated: fls. deep yellow or almost orange, ¾ in. across, the tube ½ in. long and much exceeding the short-toothed calyx. Mts. of Java. B.M. 7217. Gn. 40:823. G.M. 34:758–9. Not hardy north.

AA. *Flowers purple (or white).*

6. **Japónica**, Gray. Scape 1–2 ft. tall, bearing several superimposed whorls of clear purple fls.: plant glabrous, not mealy: lvs. oblong-obovate or spatulate, obtuse, convex above, much reticulated, the margins with small teeth: fls. 12 or more in each whorl, about 1 in. across, the lobes obcordate, the corolla-tube nearly three times as long as the short calyx-lobes, all the fls. prominently stalked. Japan. B.M. 5916. F.S. 19:1950–1. I.H. 18:69. Gn. 29, p. 382. R.H. 1871:570; 1895, p. 424. F.M. 1871:537–8; 1872:9.—There are white-flowered forms. Blooms early in summer to midsummer. Makes a noble plant in deep moist soil and a shaded place. Hardy at the North.

4. SINENSES.

A. *Calyx loose and large, often inflated.*

B. *Lvs. deep-lobed.*

7. **Sinénsis**, Sabine (*P. Chinénsis*, Hort.). CHINESE PRIMROSE. Figs. 1951, 1952. Trunk short and woody, but as known in gardens the plant is practically stemless, the ample foliage and the strong short scapes arising directly from the surface of the ground or very near it: whole plant soft-hairy: lvs. oblong-ovate to nearly round-ovate, soft and usually limp, several-lobed and the lobes toothed, long-petioled: scapes erect, several: fls. now of many colors, several to many in an umbel, large and showy, salverform, the segments obcordate: calyx inflated. China. Winter bloomer, as grown in greenhouses. B.M. 2564. B.R. 7:539 (as *P. prænitens*). F.S. 22:2334–37. I.H. 32:551; 35:42. Gn. 51:1124 and p. 469. G.C. III. 25:181, 203, 205. Gng. 2:91. A.F. 8:623,

625, 671. F.R. 4:29.—The Chinese Primrose is now exceedingly variable. There are double-fld. forms of various shapes and colors and of various degrees of doubling. For pictures of various double and half-double forms, see R.H. 1867:250, 330. F.S. 20:2145. I.H. 31:512; 35:42; 38:126. The normal form of this Primrose has a somewhat flat-topped flower-cluster, but there are forms with pyramidal and elongated clusters. Var. **stellàta** (*P. stellàta*, Hort.) is a form with handsome star-like long-stemmed fls. in successive whorls or tiers in a long open cluster: recent. Gn. 53, p. 229; 57, p. 52. A.G. 18:201; 20:384–5. A.F. 12:605. Gng. 5:167. Pretty. *Primula Sinensis* was introduced into England from Chinese gardens in 1820, but it was not until 1879 that the original wild form was known to botanists. For accounts and pictures of this wild Primrose as grown in English gardens, see essay by Sutton in Journ. Royal Hort. Soc. 13:99 (1891). G.C. III. 5:115; 8:564; 9:209; 11:13 (figure reproduced in A.G. 13:245). Gn. 49:1058. B.M. 7559. The native color of the Chinese Primrose seems to be on the order of pink, but there are many colors in the cult. forms,—from pure white to red. There are now crested or fringed forms (var. **fimbriàta,** Hort.), and those with a frill or extra corolla projecting from the throat (Fig. 1952). Gt. 43:1402; 45:1432; 46, p. 192. The lvs. are variable in shape and depth of lobing. Some forms have crisped leaves (var. **filicifòlia,** Hort.). The improvement of *P. Sinensis* has taken place without the influence of hybridization with other species.

BB. *Lvs. scalloped or sinuate, not lobed.*

8. **obcónica,** Hance (*P. poculifórmis,* Hook.). Fig. 1953. Slender, with loose-hairy leaves (the sharp hairs often irritating-poisonous): lvs. all radical, ovate-oblong or round-oblong, long-petioled, scallop-toothed and very finely serrate: scapes many, 4–10 in. tall: fls. small, lilac or light purple, several to many in umbels, on long-spreading or somewhat drooping pedicels, the segments obcordate; calyx wide open and shallow-toothed. China. B.M. 6582. Gn. 26:456 and p. 206; 29, p. 241; 51, p. 317. G.C. III. 9:401 (house). Gt. 43, p. 138. F.R. 1:941.—Of late years this species has become a popular winter-blooming pot-plant. The fls. are nearly or quite an inch across in well-grown specimens. There is a var. **grandiflòra,** Hort., with fls. nearly or quite 1½ in. across. Gn. 51:1116. R.H. 1892, p. 114. Gt. 46, p. 193. S.H. 2, p. 52. A.F. 13:1063. Gng. 6:245. Some of the large-fld. forms have somewhat lacerated or fringed petals (var. **fimbriàta,** Hort.). Var. **ròsea,** Hort., has rose-colored fls. *P. obconica* is very easily grown. Prop. by seed.

AA. *Calyx narrow and ordinary.*

9. **cortusoides,** Linn. Fig. 1954. Lvs. in a rosette on the ground, rather large and soft, loose hairy (at least on the midrib and petioles), ovate-oblong or cordate-oblong, irregularly many-notched: scapes few to several, 6–12 in. tall, very straight, hairy: fls. rose-colored, about 1 in. across, pedicelled, in a loose, many-fld. umbel, the segments obovate and deeply notched or even lobed. Siberia. B.M. 399. R.H. 1859, p. 319. Gn. 29, p. 382.—A handsome hardy species, blooming in May in the northern states.

1955. Primula Forbesi. (X ½.)

10. **Sièboldi,** Morr. (*P. cortusoides,* var. *amœna,* Lindl., var. *grandiflòra,* Lem., and var. *Sièboldi,* Hort. *P. amœna,* Hort.). Looks like a large and robust form of *P. cortusoides,* with fls. 1½ to nearly 2 in. across, the throat usually striped and the limb in various colors, from pure white to deep purple-rose. Japan: perhaps a cultivated state of the above. B.M. 5528. I.H. 16:599. Gn. 29, p. 382; 35, p. 335; 36:721. Gng. 8:241–2. R.H. 1892:300.—The fls. are two to three times larger than those of *P. cortusoides.* In some forms the fls. are fringed. Blooms in late spring. Hardy North.

5. Monocarpicæ.

11. **Fórbesi,** Franch. Baby Primrose. Figs. 1955, 1956. Annual: slender and delicate species, with something of the habit of *P. obconica:* loosely hairy, at least on the lvs. and lower part of the scape: lvs. small, 1–2 in. long, oval-oblong to cordate-oblong, shallowly sinuate-toothed, minutely serrulate: scapes very slender, 6–14 in. high, often bent above the whorls: fls. small (about ½ in. across), light lilac, slender-pedicelled, appearing in successive umbels or whorls, the segments obcordate, calyx sharp-toothed, small, somewhat loose. China. B.M. 7246. R.H. 1892, p. 259. G.C. III. 14:685. A.F. 14:757. Gng. 7:149. F.E. 11:72.—Although first described so recently as 1886, and first exhibited in London in 1891, this plant is now one of the most popular of conservatory plants in America. It is a most profuse bloomer, beginning to flower when not more than 2 or 3 in. high and continuing until the scapes reach a height of 10–12 inches. It is particularly well adapted to growing in pans. It is easily grown from seeds, and blooms well all winter. Unless given plenty of light and room, the scapes become weak and crooked.

1956. Primula Forbesi, the Baby Primrose, at the beginning of its blooming season.

6. Barbatæ.

12. **vinciflòra,** Franch. Perennial, with a short rhizome: lvs. thin, oblong or oval, densely overlapping and forming a narrow erect crown, all erect or nearly so, the upper ones larger, all entire but ciliate, covered with reddish glands: scape short: fl. solitary, purple-violet or blue, 1½ in. across, the tube cylindrical or

long-obconic, hairy, the segments well separated and broadly obcordate; calyx small, not inflated. China. G.C. III. 1:574.—A most odd species, with vinca-like fls.

7. VERNALES.

This is a group of spring-flowering plants to which the polyanthus and the true cowslip belong. They are much varied and hybridized, and the botany of them is therefore much confused. What Linnæus called *P. veris* (meaning the vernal or spring Primula) is now dismembered into *P. officinalis*, *P. elatior* and *P. vulgaris*.

1957. Primula officinalis (× ¼).

A. *Scape strong and projecting above the lvs., bearing an umbel.*

B. *Fls. small, the limb of the corolla concave or cup-like.*

13. **officinàlis**, Jacq. COWSLIP. Fig. 1957. Stemless, minutely soft-pubescent: lvs. oval or oblong, abruptly contracted or subcordate at the base, the petiole winged, the limb unevenly denticulate or sometimes erose: scape 6–12 in. tall, bearing about 6–12 fls. in a close umbel, all the fls. pointing or drooping to one side: fls. bright light yellow, the tube about the length of the half-acute lobes of the loose large calyx, the limb expanding little beyond the bulge of the calyx (about ½–¾ in. across). Central and northern Europe, and long in cultivation.

BB. *Fls. larger, opening wide and nearly flat.*

14. **elàtior**, Jacq. OXLIP. Very like the last, but the expanded fls. twice broader, and the calyx narrow (not inflated) and with acuminate lobes: usually somewhat taller: lvs. very rugose. Europe, particularly in mountains and in the northern parts.

AA. *Scape usually short or almost none, the umbels therefore borne in the foliage and the fls. standing singly on the long rays (exceptions in No. 16).*

15. **vulgàris**, Huds. (*P. acaùlis*, Jacq.). PRIMROSE. Leaves many, tufted, sessile or tapering to a narrow base, long oblong-obovate and obtuse (6–9 in. long), rugose, irregularly shallow-toothed and denticulate: fls. 1 in. or more across, pale yellow, the limb flat, usually not equaling the leaves, borne on long, slender pedicels; calyx not inflated, the lobes acute or acuminate. There are double-fld. forms. B.M. 229. Gn. 29, p. 385. R.H. 1880:90.—Var. **cauléscens**, an occasional state, has some of the scapes more or less prolonged. Europe, widely distributed. For pictures of various forms of *P. vulgaris*, see Gn. 54:1184 and pp. 142, 143; 7, pp. 319, 345; 11, p. 127; 12:101. A.F. 13:1102. Gng. 6:245. R.H. 1898:12.

16. **Polyántha**, Hort. POLYANTHUS. Figs. 1950, 1958, 1959. A garden group supposed to be hybrids of *P. officinalis* or *P. elatior* and *P. vulgaris*, although many botanists refer it to *P. elatior* direct. Some consider it to be a direct development of *P. vulgaris*. Whatever its origin, the group is distinct for garden purposes, and it is the commonest form of hardy Primula known in American gardens. The fls. are several to many in an erect umbel terminating a scape that usually stands well above the long lvs.; the colors are mostly yellow and red-and-yellow. There is a form with one corolla inside the other, known as Duplex or Hose-in-Hose. The Polyanthus is perfectly hardy, blooming in earliest spring. Prop. usually by division. *P. variabilis*, as used in horticultural literature, usually refers to this Polyanthus group or to plants of similar origin.

8. CAPITATÆ.

17. **denticulàta**, Smith. Scapes 4–18 in. tall, bearing a dense umbel or head of pale purple fls.: lvs. in a rosette on the crown, usually not full grown until the flowers are past, and surrounded beneath by short, broad, thick, leaf-like bracts; leaf-blades oblong-obovate or spatulate, usually narrowed into a winged stalk, sharply denticulate, more or less mealy: corolla-tube about twice as long as the calyx-teeth, the corolla-lobes obcordate. Himalaya region, 7,000 to 13,000 ft., and said by Hooker to be "the commonest Himalayan Primula, and very variable." B.M. 3959. B.R. 28:47. Gn. 11, p. 127; 29, p. 382; 35, p. 529; 41, p. 588.—A hardy plant, usually treated as a rockwork subject. Blooms in earliest spring. Var. **purpùrea**, Hort., has dark purple fls. Var. **álba**, Hort., has white fls. Gn. 50, p. 372. Var. **pulchérrima**, Hort., is very robust, with deep purple fls. in dense heads.

Var. **Cachemiriàna**, Hook. f. (*P. Cachemiriàna*, Munro. *P. Cashmeriàna*, Hort.). Lvs. nearly or quite full grown when the fls. are in bloom, usually more mealy (yellow-mealy beneath and sometimes on top): fls. rich purple with yellow center. Western Himalayan region. R.H. 1880:330. *P. Sibirica*, var. *Kashmiriana* (B.M. 6493) is a different plant. See No. 24.

18. **capitàta**, Hook. Much like *P. denticulata*, but lvs. appearing with the fls. and the fleshy leaf-bracts few or none: according to Hooker, it "has finely denticulate leaves, often snow-white with meal beneath, but sometimes not so; a tall also mealy scape and globose densely crowded head of sessile flowers which open slowly, and the uppermost unexpanded ones are depressed and imbricate over one another like the tiles of a house. The corolla is of very deep purple-blue, the tube and calyx both short." Eastern Himalaya. B.M. 4550, 6916 B. F.S. 6:618. Gn. 16:210; 29, p. 382; 45, p. 503; 50, p. 373; 54, p. 467. J.H. III. 32:209.

19. **eròsa**, Wall. (*P. capitàta*, var. *críspa*, Hort. *P. denticulàta*, var. *eròsa*, Duby). Differs from *P. denticulata*, according to Hooker, "in its much slenderer habit, in always (except on young parts) wanting the meal on the leaves, which are developed at flowering time, are translucent with strongly erose and denticulate margins, and have a strongly reticulated surface, and the petioles are often red; the umbels are loose or dense-flowered, and the flowers in our garden specimens are of a far deeper purple than is usual in *P. denticulata*." Hooker says that the lvs. are sometimes 18 in. long. Temperate Himalaya. B.M. 6916A.—This name does not appear in the Amer trade, but the species is very likely to pass as *P. denticulata* or *P. capitata*.

9. AURICULATÆ.

20. **auriculàta**, Lam. (*P. longifòlia*, Curt.). Scapes 4–10 in. tall, from a rosette of oblong-obovate smooth irregularly denticulate lvs.: fls. in a rounded head or umbel, purplish, with a whitish eye, the tube 1 in. or more long and much exceeding the calyx, the involucral scales more or less auriculate. Mts. of Greece to Persia. B.M. 392.

21. **ròsea**, Royle. Tufted, 4–8 in. tall, glabrous, not mealy: lvs. many, oblong-obovate or oblanceolate, crenulate or small-toothed: fls. few to many in a rather loose head (each flower distinctly stalked), rose-red, more or less drooping, the tube somewhat exceeding the long sharp calyx-teeth, the lobes obcordate. Western Himalaya. B.M. 6437. Gn. 50:1091, the large-fld. form (var. *grandiflora*); 16:187; 29, p. 382; 31, p. 597; 39, p. 417. G.C. II. 19:540. F.M. 1879:360. R.H. 1880:330.—One of the best of the alpine Primulas.

10. Farinosæ.

A. *Plant mealy, at least when young.*

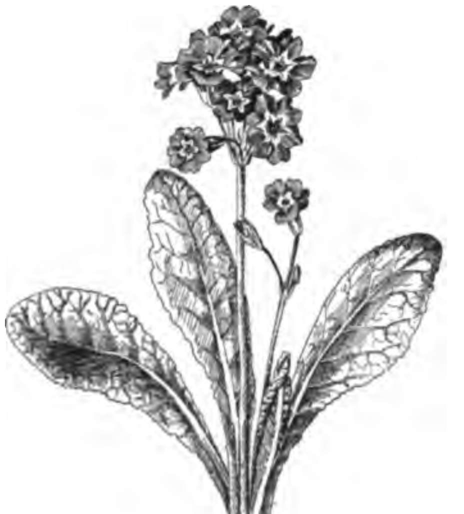
22. **farinòsa**, Linn. Scapes 9 in. or less tall: lvs. oblong-obovate, spatulate or cuneate-lanceolate, tapering into a short flat petiole, denticulate: umbel mostly few-fld., bearing pretty lilac or flesh-colored fls., with a yellowish eye, the corolla-lobes obcordate and separate at the base and ¼ in. or less long. Generally distributed in boreal and alpine regions of the northern hemisphere, in N. Amer. occurring in Maine, on Lake Superior and in the mountains as far south as Colorado. Gn. 29, p 385.

AA. *Plant green or very nearly so.*

23. **Mistassínica**, Michx. (*P. farinòsa*, var. *Mistassinica*, Pax. *P. pusilla*, Hook.). Plant small and slender, with only mere traces of mealiness if any: lvs. only ⅛ in. long, stalked or not, spatulate or obovate, toothed or repand: scape about 6 in. tall, with few fls., the latter flesh-colored and shorter than in *P. farinosa*. Arctic America, and south to northern New England, central New York, Lake Superior, etc. B.M. 2973, 3020.

24. **Sibírica**, Jacq. Plant wholly green, the scapes 6 or 7 in. or less high: lvs. thickish, oval, obovate or round-ovate, nearly or quite entire, about ¼ in. long: fls. few, lilac or pink, the corolla-lobes obcordate and about ¼ in. long: involucral bracts almost spurred at base. Arctic and alpine regions of the northern hemisphere. B.M. 3167, 3445 (the latter as var. *integerrima*).

Var. **Kashmiriàna**, Hook., has fls. smaller, the corolla-tube scarcely exceeding the calyx, and the corolla-lobes narrower. B.M. 6493. Western Himalaya. Not to be confounded with *P. denticulata*.var. *Cachemiriana*, No. 17.

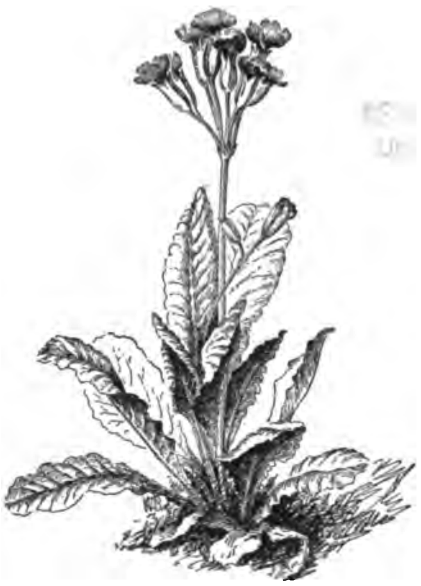


1958. Polyanthus—Primula Polyantha (× ⅓).

11. Nivales.

A. *Fls. purplish or white.*

25. **Cusickiàna**, Gray. Scapes 6 in. or less tall, each bearing 2–4 violet or white fls.: lvs. oblong-spatulate or narrow-oblong, about 2 in. long, entire or very nearly so: involucre bracts 2 or 3, conspicuous, unequal: corolla-lobes retuse, the tube little if any exceeding the calyx-lobes. Early spring. Eastern Oregon.—Offered by dealers in native plants



1959. Polyanthus—Primula Polyantha.

26. **Rúsbyi**, Greene. Larger than *P. Cusickiana*, the lvs. 2–5 in. long, denticulate: scapes sometimes 1 ft. tall, 6–10-fld., the fls. deep purple with yellow eye: involucre bracts 3 or more, subulate or ovate: corolla-lobes obcordate, the corolla-tube longer than the calyx. Mts. in New Mex. and Ariz. B.M. 7032.—Offered by dealers in native plants.

AA. *Fls. yellow.*

27. **Stuàrtii**, Wall. An exceedingly variable Himalayan species with drooping yellow fls. in a terminal umbel: radical lvs. 5–10, narrowly oblanceolate, acute, sharp-serrate or sometimes entire, yellow, mealy beneath: scape 12–18 in. tall, bearing a mealy-covered inflorescence: fls. light yellow, with tube twice the length of the usually acute-lobed calyx, the lobes orbicular and emarginate or sometimes orbicular and entire. B.M. 4356. G.C. II. 19:824; 25:528. Gn. 29, p. 382.—Fls. 1 in. or more long.

L. H. B.

PRINCE, WILLIAM, the second proprietor of the Prince Nursery at Flushing, L. I. (New York), was born about 1725, and died in 1802. The nursery, which was perhaps the first large commercial one in America, was established about 1730 by his father, Robert Prince. The Huguenots who settled at New Rochelle and on the north shore of Long Island brought with them a variety of French fruits, and the interest thus created in horticulture resulted in the establishment of this first nursery. For a number of years attention was confined chiefly to the fruit trees with which to stock the new country, and it was only when more settled conditions came that the culture of ornamental trees and shrubs was introduced. Under William Prince the nursery grew rapidly in importance until the war of the Revolution. One of the early advertisements reads as follows, under date of September 21, 1767:

"For sale at William Prince's nursery, Flushing, a great variety of fruit trees, such as apple, plum, peach, nectarine, cherry, apricot and pear. They may be put up so as to be sent to Europe. Capt. Jeremiah Mitchell and Daniel Clements go to New York in packet boats Tuesdays and Fridays."

The extension to ornamental branches is seen in an advertisement in the New York "Mercury" of March 14, 1774, which reads as follows:

"William Prince, at his nursery, Flushing Landing, offers for sale—
110 large Carolina Magnolia flower trees, the most beautiful trees that grow in America, four feet high.
50 large Catalpa flower trees; they are nine feet high to the under part of the top and thick as one's leg.
30 or 40 Almond trees that begin to bear.
2,500 white, red and black Currant bushes.
50 Fig trees.
Lisbon and Madeira Grape vines.
5,000 Hautboy, Chili, large English and American Strawberry plants.
1,500 white and 1,000 black Mulberry trees.
Also Barcelona Filbert trees."

The establishment had attained such public importance that when the British took possession of Flushing, August 29, 1776, after their victory at the battle of Long Island, the commanding officer, General Howe, placed a guard over the nursery to protect it from depredations, and this was continued until all danger was past. The extent of the business, as well as the paralyzing effect of the war, is shown from an advertisement of Mr. Prince, shortly after the British occupation, offering 30,000 young cherry trees for sale as hoop-poles, the only use to which they could be put during the Revolution. The loss of domestic business was largely compensated by the great demand for American native trees and shrubs wanted by the officers of the British army to be sent to friends in England and Germany.

A return of peace brought with it increased trade, to make good the depredations of the soldiery as well as to re-stock the orchards of those who for seven years past had paid more attention to the science of war than to the pursuits of horticulture; and a catalogue of 1794, still preserved, contains fully as many varieties of fruit as those of some nurseries of the year 1900, over a century later; apricots and nectarines, for instance, each being represented by ten varieties.

Not only was everything of merit imported, but the origination of new varieties by a careful selection of seedlings was enthusiastically carried on. Two plums, still well known, date from this period, Prince's Yellow Gage being originated in 1783 and the Imperial Gage in 1794. The "Treatise on Horticulture" mentions that in 1790 no less than twenty-five quarts of green gage pits were planted, from which seedlings were obtained of every color and shape, it being probable that the Washington plum was originated in that year. Before the death of this William Prince, the nursery business had been taken up by his sons, William and Benjamin; the former on new ground, called the Linnean Botanic Garden and Nursery, and the latter at the original place, called "The Old American Nursery."

William Prince, third proprietor of the Prince Nurseries at Flushing, was born Nov. 10, 1766; married Mary Stratton, Dec. 24, 1794, and died April 9, 1842. During his lifetime the Prince Nursery was one of the centers of horticultural and botanic interest in America, and reached the height of its fame. He continued the work of his father in the introduction of all foreign trees and plants of value, the discovery of unknown American species and the creation of new varieties from seed. One of the trees introduced to great popularity in the younger days of William Prince the second was the Lombardy poplar, of which he advertised in 1798 no less than 10,000 trees 10–17 ft. in height. For several years the Lombardy poplar was the fashionable shade tree. Long avenues of them were planted by the wealthy; and their leaves were considered valuable for fodder. In 1806 the tide turned, owing to a belief that they harbored a poisonous worm, and thousands were cut down and burned.

In 1793 William Prince bought from Bayard, LeRoy and Clarkson, the property on the north side of Bridge street in Flushing, across from the old nursery, containing eighty acres, and it was soon transformed into a place of arboreal beauty. For fully fifty years the nursery was carried on much less for profit than from a love of horticulture and botany. It was designed to contain every known kind of tree, shrub, vine and plant known to England or America that possessed any horticultural merit. In Europe probably the only one of the same character was that of the London Horticultural Society. When the great Northwest was explored by Lewis and Clark, many of the botanical treasures found a home at the Flushing Nurseries. Among them the Mahonia became very popular, the earlier specimens being sold at $20 each.

1960.

Wm. R. Prince

The catalogues from 1815 to 1850 ranked among the standard horticultural publications of the country. The number of varieties of fruits cultivated seems scarcely credible in these days, when many nurseries are conducted solely for profit, and only the trees or plants which find a ready sale are propagated. The collection of roses at one time embraced over 800 kinds; of dahlias over 350 varieties; the collections of camellias, of citrous fruits and of grapes were enormous, while the marvelous variety of the ordinary fruits can be seen from the "Pomological Manual." The "Treatise on Horticulture" mentions that at that time (1828) the nursery contained more than 20,000 plums, of 140 varieties, while the apricots numbered 35 and the grapes about 240 varieties. The catalogue of 1845, which enumerates only the best varieties, contains 350 kinds of apples, 300 of pears, 120 of cherries, 200 of plums and 160 of peaches.

In 1828 Mr. Prince wrote and published the "Treatise on Horticulture," which was the first work of the kind produced in America. Mr. Prince was a man of great energy of purpose, of excellent judgment, with a love for scientific studies, and possessed of a most amiable character. By indefatigable effort he succeeded in having roads and bridges built which shortened the distance to New York fully one-half, and soon after the invention of steamboats he had a regular line of boats established between Flushing and New York. He was a zealous churchman, a vestryman of St. George's church, Flushing, as early as 1798, and continued in the vestry 32 years, during 14 of which he was warden. In the words of Mandeville's History of Flushing, he was "universally esteemed in life and regretted in death."

William Robert Prince (Fig. 1960), fourth proprietor of the Prince Nursery, at Flushing, was born November 6, 1795; married Charlotte C. Collins, daughter of Governor Collins, of Rhode Island, October 2, 1826, and died March 28, 1869. He inherited his father's love of botany and his great energy. He was connected with the American Institute, National Pomological Society, Massachusetts Horticultural Society and many other important organizations, in whose transactions he took a prominent part. In 1830 he wrote, with the assistance of his father, the "Treatise on the Vine," a work of high importance. In 1831 he issued the "Pomological Manual" in two volumes, an important treatise on all fruits except apples. In 1846 he published the "Manual of Roses." In his later days Mr. Prince received the honorary degrees of M.D. and LL.D.

When a boy he was sent for a year to Canada in order to become proficient in French, as there were then no schools of languages in New York, and the European correspondence was an important feature in the horticultural business. In his early manhood he botanized through the entire line of Atlantic States in company with Professor Torrey, of Columbia College, and Professor Nuttall, of Harvard. In California, during 1849 and 1850, while others were searching only for gold, he was making collections of the trees and wild flowers of that country. The oldest cedar of Lebanon in the United States, as well as the oldest Chinese magnolias, salisburias, Mt. Atlas cedars, paulownias and purple beeches are to be found to-day in the grounds of the Prince homestead, together with many other unique specimens. When the disease of the Irish potato caused a fear that it would have to be replaced by some other vegetable, he imported the Chinese yam or potato (*Dioscorea Batatas*), paying $600 for the tubers contained in the first consignment,—a consignment which could be placed in a small box. About the same time he introduced sorghum, or Chinese sugar cane. He was unwearied in his endeavors to promote silk culture in the United States. He imported not only the silkworms but the mulberry trees to feed them, and built a large cocoonery for their accommodation. He had vast plantations of mulberries in different places. He was offered $100,000 for the one near Norfolk, Va. It is a curious circumstance, illustrating the general interest in mulberry culture at that time, that cuttings of the *Morus multicaulis* were used as currency in all the stores in the vicinity of Flushing, passing current everywhere at the rate of 12½ cents each. Mr. Prince's familiarity with the French language greatly facilitated his intercourse with European horticulturists, and he was in constant communication with French, Belgian, Dutch and German nurseries.

At the time of his marriage he purchased additional property adjoining the nursery of his father, and subsequently added three other large areas to the nursery establishment. He was always more of a horticulturist and botanist than business man, and, as in his father's days, the Linnean Botanic Nursery continued to be celebrated for its great variety of vegetable life rather than a commercial establishment. He was a vigorous and prolific writer, and down to the time of his death was a constant contributor to horticultural literature.

L. B. Prince.

PRINCE EDWARD ISLAND. See *Canada*.

PRINCE'S FEATHER. *Amaranthus* and *Celosia*.

PRÌNOS. See *Ilex*.

PRIÒNIUM (Greek, *saw;* referring to leaves, which are sword-shaped, with serrate edges). *Juncàceæ*. A genus of one species, a tender aquatic plant from S. Africa, where it grows in great masses in running water. This is one of the few plants of the rush family having the lvs. crowded at the top of an erect, woody stem 5–6 ft. high. Generic characters: ovary sessile, globose, 3-celled; ovules axile, usually 2 in a cell: stigmas 3, sessile, spreading: capsule rigid, 3-valved: seeds usually only 1 in each cell. For further description, see Flora Capensis 7:28. This plant may be grown in a pot placed in a pan of water, and, if desired, may be planted out for the summer in a wet position.

Palmita, E. Mey. Stem stout, often forked, 2–4 in. in thickness, reaching a length of 5–6 ft.: lvs. linear, rigid, glabrous, 3–4 ft. long, in dense rosette at summit of stem: inflorescence a large, dense, terminal panicle on long peduncle: perianth and bracts ⅛ in. long. B.M. 5722.

F. W. Barclay.

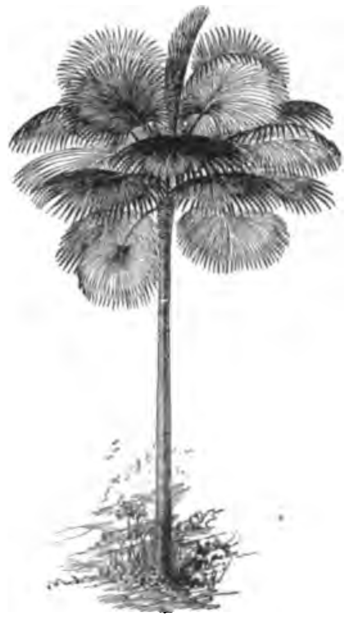
PRITCHÁRDIA (W. T. Pritchard, British consul at Fiji in 1860). *Palmàceæ*. Nine species of spineless fan palms from small islands of the South Pacific. True Pritchardias, according to Wm. Watson, differ from all other fan-leaved palms in the form of the blade, which is cuneate in outline; the lvs. are also exceptionally soft and pliant. The best of the genus, probably, is *P. Pacifica*, which is remarkable for its fibrous, fluffy leaf-stalks. Pritchardia is allied to several genera mentioned under Licuala (which see), being distinguished as follows: ovary 3-cornered or 3-lobed, narrowed into a strong style: corolla with persistent tube and deciduous segments: embryo subbasilar. The genus was monographed by Beccari in Malesia, vol. 3 (1890). The best horticultural account is that of Wm. Watson in G.C. III. 13:332 (1893). The species in the supplementary list below are very imperfectly known.

A. *Fr. black-purple, globose, 6 lines thick.*

Pacifica, Seem. & Wendl. Fig. 1961. Trunk attaining 30 ft. high, 10–12 in. thick, straight, smooth: lvs. 4½ ft. long, 3¼ ft. wide, densely covered when young with whitish brown tomentum, finally glabrous; segments about 90; petiole 3⅓ ft. long. Samoa, Fiji. I.H. 21:161. F.S. 22:2262.—The illustration (Fig. 1961) is adapted from Martius.

AA. *Fr. yellow or red, 9 lines thick.*

Gaudichaùdii, H. Wendl. (*P. macrocárpa*, Linden). Trunk 20 ft. high, 1 ft. thick: lvs. roundish, 3–4 ft. long, covered beneath with pale brown matted wool, slit for about 1 ft. into about 60 segments; petioles 2–3 ft. long. Hawaiian Islands. I.H. 26:352.



1961. Pritchardia Pacifica.

AAA. *Fr. greenish, globose, 15–20 lines thick.*

Mártii, H. Wendl. Trunk generally not exceeding 5–6 ft., but as thick as in *P. Gaudachaudii:* lvs. glabrous and glaucous below, not woolly; segments about 40, not as deep; petioles longer. Hawaiian Isl.—Cult. in S. Calif.

P. Bornеénsis, Hort., was introduced in 1891 by Linden, but seems unknown to botanists.—*P. filamentòsa*, Hort., is presum-

ably a catalogue error for P. filifera.—*P. filifera*, Linden, is Washingtonia filifera.—*P. grándis*, Bull, is Licuala grandis.—*P. Periculòrum*, Wendl., is said to be characterized by its dark brownish petioles and obliquely spherical fr. Pomotu Isl.—*P. Thùrstoni*, Drude, is said to be distinguished by its long slender fl.-stalks like fishing rods bearing a thyrse-like inflorescence.
W. M.

PRIVET. See *Ligustrum*.

PRIVET, MOCK. See *Phillyrea*.

PROBOSCIS FLOWER. *Martynia proboscidea*.

PROCHNYÁNTHES (Greek, *kneeling* and *flower;* referring to the sudden bend in the flower which is likened to a knee). *Amaryllidàceæ.* A genus closely related to Polianthes and Bravoa, differing chiefly in the shape of the flowers. Stems slender, from oblong tubers which crown short, thick rootstock: lvs. mostly basal; inflorescence a lax spike or raceme: fls. always in pairs, tubular below, abruptly bent at the middle, bell-shaped above; stamens 6, included: fr. 3-celled, many-seeded. Native of western Mexico. A genus, discovered by Dr. E. Palmer in 1886, of which two species have been described. It has been misspelled Prochynanthes.

viridéscens, Watson. Stems 4–6 ft. high: lvs. mostly basal, numerous, 1–2 ft. long, 2–3 in. broad, erect: fls. 5–30 pairs, brownish; pedicels nearly wanting to 1½ in. long. Until recently supposed to be a very rare species, known only from near Guadalajara, Mexico, but found by the writer to be very common in the mountains of the states of Jalisco, Durango and Zacatecas. Not yet in the trade, but it is a plant that deserves to be introduced.

P. Bulliàna, Baker. Hardly differs from the above but described as having larger fls., which are sessile instead of having a long pedicel: fls. brownish green. The fls. are not jointed at the pedicel as Baker says. B.M. 7427.—*P. viridiflòra* mentioned under B.M. 7427 is a mere slip of the pen for P. viridescens.
J. N. Rose.

PROMENÆA (named presumably after the prophetess of Dodona). *Orchidàceæ.* A genus of small herbs with the habit of Odontoglossum but having lvs. of paler green. It is one of the many genera formerly united with Zygopetalum. Lvs. conduplicate in the bud: pseudobulbs evident: inflorescence originating above the annual leafy axis, 1–2-fld.: sepals and petals subequal, spreading, the lateral sepals forming a mentum with base of the column: labellum movably joined to the base of the column. For culture, see *Zygopetalum*.

citrina, Donn. (*Zygopétalum xanthìnum*). A little orchid with small ovate pseudobulbs and lanceolate lvs. 2–3 in. long: fls. pale lemon-yellow; labellum 3-lobed, with crimson spots in the throat; column streaked with red. June. Brazil. Gn. 20, p. 61.

graminea, Lindl. Lvs. about 6 in. long, lanceolate, faintly striate, jointed to the equitant bases: scapes 3–5, clustered: fls. dirty yellow, spotted with brown; sepals and petals oblong-lanceolate; labellum oval, crisp and toothed on the margin, shaded with rose and blotched with crimson-brown. Spring. Brazil. B.M. 5046. G.C. II. 23:636.—On account of the absence of pseudobulbs this species is now generally placed in the genus Keffersteinia.

stapelioides, Lindl. Pseudobulbs 4-angled, 1–2-lvd.: lvs. lanceolate, spreading, pale glaucous, reticulate: peduncle 2-fld.: fls. green outside, yellowish inside, speckled and banded purple. Brazil. B.R. 25:17.
Heinrich Hasselbring.

PROPAGATION. See *Cuttage*, *Graftage*, *Layerage*, *Nursery*, *Seedage*.

PROSÁRTES. See *Disporum*.

PROSÒPIS (meaning obscure). *Leguminòsæ.* A genus of about 18 species of tender trees and shrubs including the Mesquit and the Screw Bean, two forage plants of considerable value in the arid regions of S. Calif. and the Southwest. The species of Prosopis may be spiny or not, the spines axillary, solitary or in pairs, or sometimes only the stipules spinescent: lvs. bipinnate, the pinnæ in 1 or 2, rarely many, pairs; lfts. few or many: fls. small, in cylindrical spikes or globose heads.

The Mesquit, *P. juliflora* or *P. dulcis*, is a thorny shrub which ordinarily grows only a few feet high in the desert, but under favorable circumstances it makes a tree 60 ft. high. It ranges from California to Texas and south to Buenos Ayres. It is also called Algaroba and Cashaw. It was extensively planted in the Hawaiian Islands many years ago by the missionaries. In great stress of circumstances it has been known to send its roots down a depth of 60 ft. It is suitable for hedges. The sweetish pods are eaten chiefly by cattle. Seeds and plants are offered in S. Calif.

A. *Plant spiny: pod straight or sickle-shaped.*

juliflòra, DC. (*P. dúlcis*, Kunth). Mesquit or Mesquite. Plant with stout axillary spines or often unarmed: lfts. 6–30 pairs, linear, ¼–1½ in. long: spikes cylindrical, 2–4 in. long: pod ⅓–½ ft. long or more.—The Californian form is said to bear smaller pods than the tropical form, and to be hardier.

AA. *Plant less spiny: pod spirally twisted in numerous turns.*

pubéscens, Benth. Screw Bean. Tornillo. Plant merely spinescent on petioles: lfts. 5–8 pairs, oblong, ¼–⅓ in. long: spikes globose to cylindrical, 1½–2 in. long: pod 1–2 in. long. Tex., Calif., Mex.
W. M.

PROSTANTHÈRA (Greek, *to add to*, and *anther:* referring to the connectives of the anthers being spurred or crested beneath). *Labiàtæ.* About 40 species of Australian shrubs or subshrubs, with resinous glands, and commonly strong-scented. Fls. borne in spring or summer, solitary, axillary or opposite in terminal racemes; calyx-tube usually striate, the limb 2-lipped; corolla-tube short, dilated into broad bell-shaped throat; stamens 4, in pairs; anthers with 2 perfect cells; the connective not elongated but prominent at the back, sometimes cristate and usually tipped with a crest of short points or hairs, though occasionally the appendages are very short or wanting. Flora Australiensis 5:91 (1870).

nivea, A. Cunn. A beautiful shrub, 3–6 ft. high, glabrous except the corolla or with a few appressed hairs: stem and branches slender, twiggy, upper ones 4-angled. lvs. ½–1½ in. long, oblong-lanceolate or linear, entire, pale green; margins involute, especially on older lvs.: fls. snow-white or tinged with blue; pedicels short; calyx about ¼ in. long, green; corolla ½–¾ in. across. Rocky hills, N. S. Wales and Victoria. B.M. 5658.—A tender shrub, which can be safely grown only where the lemon is hardy. Introduced by Franceschi, Santa Barbara.
F. W. Barclay.

PROTÈA (from Proteus, the sea-god, who changed into many forms; alluding to the baffling diversity of the species). *Proteàceæ.* Proteas are tender shrubs which are among the most attractive and characteristic plants of the Cape of Good Hope,—a region whose plant life is unique. Their flower-heads are said to look like a "glorified artichoke." Indeed *P. cynaroides* (Fig. 1962) is named from this very resemblance. (*Cynaroides* means cynara-like; and *Cynara* is the artichoke.) It has bright pink flower-heads which last several months. The structure of the flower-heads is the distinctive feature of the whole family of the Proteaceæ. The showy parts of the flower-head are the bracts, which are often rigid, colored, and overlap one another like the scales of a hard cone or an artichoke. "When the heads of *P. cynaroides* first open," says Watson, "they are full of honey and are known to the Boers as honey-pots." This honey is collected and made into a kind of sugar. The blooming of the "honey-pots" is a great occasion for picnics. Watson saw large bushes of *P. speciosa* at the Cape, which he declared were quite as effective as big specimen rhododendrons. "Fifty years ago," writes Watson in 1891, "there were about 30 species of Protea included among popular greenhouse plants in England; now one may safely say there is not one, the few really under cultivation being only in botanical collections." In 1881 Hooker wrote: "That these and many other plants requiring like treatment will be reintroduced, and will be the wonders of the shows for many successive seasons, is as certain as that they were once the glories of the old flue-heated houses that our forefathers called stoves, in which orchids quickly perished, and Banksias and Proteas throve magnificently." Over 40 colored plates of Proteas have been published, of which 23 appeared in Andrews' Bot. Rep. between 1797 and 1811.

The interest in proteaceous plants is growing in southern California. Proteads have a reputation for being difficult to cultivate away from the Cape, but Hooker's statement seems to indicate that their culture is not so much difficult as special. Under glass they are said to require a coolhouse which is airy and sunny. "The one great danger to cultivated Proteads," says Watson, "is excessive watering, and to guard against this it is found to be a good plan, in the case of delicate species, to place the pot in which the plant is growing inside a larger one, filling up the space between with silver sand. The latter is always kept moist." Many of the species need staking, as the shoots are quick to break off at the base if unsupported.

The family Proteaceæ contains 14 genera, of which 10 are typical of southern Africa and 4 of Australia. According to Bentham and Hooker, the family is as distinct as possible and has never been confused by any one with anything else. The most popular member of the family for greenhouse culture in America at present is the Silk Oak, or Grevillea. In southern California the interest in the family is now centered on the Silver Tree, Leucadendron, which is the characteristic tree about Cape Town and practically the only native tree of any kind growing there in quantity. Proteas ripen seeds freely, and seeds can be easily procured from the Cape. Of recent years the two species which have attracted the most attention in the horticultural world are *P. cynaroides* (G.F. 8:35. G.C. III. 17:773. G.M. 38:407. Century Book of Gard. 310), and *P. nana* (B.M. 7095. G.F. 4:413. G.M. 35:268, 269).

The Australian Proteaceæ are monographed in the Flora Australiensis. Good horticultural accounts are those of Wm. Watson in G.F. 8:34 and 4:412, which have been liberally quoted above.

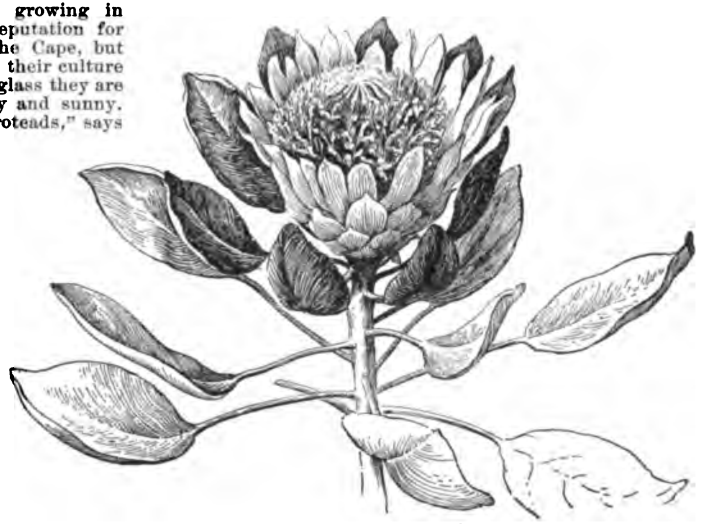
W. M.

PROTEADS. Same as *Proteaceæ.*

PROTECTION, as used by the gardener, is an indefinite term. A plant may need protection from living agencies, as animals, birds, insects, or plants (including fungi and weeds)—or it may need protection from the weather,—heat, cold, rain, drought. Generally, however, the gardener means by "protection," winter-protection, which again covers two very distinct ideas. Most Cape bulbs, for instance, are ruined if they are frozen; tulips are not. Yet Cape bulbs can sometimes be wintered outdoors if they are protected by a covering heavy enough to keep out frost. Strawberries, on the contrary, are covered after frost with a light mulch, which is designed merely to keep the plants from being heaved by alternate freezing and thawing. These are the main objects of winter protection in the East, at least with herbs. In the prairie states the fruit trees also need protection from the hot, drying winds of summer and from sun-scald, which are not the important considerations with eastern fruit-growers. See ***Winter Protection.*** Allied topics are discussed under ***Greenhouse, Coldframes*** and ***Hotbeds; Insects, Insecticides, Fungicides*** and ***Weeds; Transplanting.***

PROTOPLASM. A substance, sometimes called the physical basis of life, apparently universally present and functional in all living bodies, plants and animals alike. It varies greatly in consistence, owing to the proportional amount of water contained, from a semi-fluid to a firm solid; and its chemical composition is constantly changing by its own constructive and destructive activity. The slimy substance observed when bark is separated from rapidly growing stems is mainly protoplasm, and is a good illustration of its condition in young tissues and of its appearance in quantity.

As usually seen under the microscope in the cells of living plants, protoplasm is a mucilaginous or plastic mass, nearly transparent, colorless or gray from the numerous fine embedded granules, and often exhibits streaming or other kinds of motion. It fills very young and actively forming cells completely full, like thin jelly in a glass flask. But as growth continues bubbles of clear water appear, which soon enlarge and then coalesce, so that at length the protoplasm becomes a thin lining to the cell-wall and incloses a central body of water. Not unfrequently, however, several strings or bands, more or less branched, of the soft substance stretch through the water across the cell, and in these may often be observed streams of moving granules. The protoplasmic layer or lining as described remains as long as the cell lives and is, in fact, the only part of the cell which exhibits any of the phenomena of vitality. When it disappears, as it does from the heart-wood and outer bark of trees and often of other plants, the tissues are lifeless, and any functions they subsequently perform are solely mechanical or physical.



1962. Protea cynaroides (× ⅛).

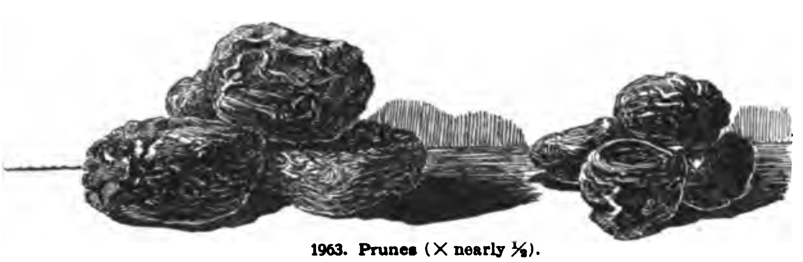
In living cells of all plants (except, perhaps, certain algæ and fungi) there is a specialized and very important portion of the cell-protoplasm, usually spheroidal or disk-form, called the nucleus. The whole protoplasmic mass is capable of absorbing nutriment and of appropriating it in its own growth, and it is all sensitive to external agents or stimuli, like heat, light, mechanical shock, etc.; but the nucleus is essential to cell-multiplication and to reproduction. No new cells are ever formed, unless in the plants excepted above, without the active aid of these minute but peculiarly endowed bodies; hence no growth, beyond the simple enlargement of cells previously formed, can take place without them. Cells increase by the self-division of those already existing, and in this the nuclei are the active agents. Two new cells are actual, though enlarged, halves of one former cell; the young cells, therefore, repeat the characteristics of the old one as nearly as any such transmission can take place. In sexual reproduction there is a definite and essential coalescence of two nuclei into one, and the result springing from the latter is necessarily a union of the characteristics of both parents; but in other cell-formations there is no such chance for departure from the preëxisting type. This explains why the characteristics of stock and cion do not become mixed however intimate the union; the tissues adhere together and nutrient fluids pass up or down, but there is no intermingling beyond this. No cell becomes half-and-half of stock and cion. Each preserves its individuality, through the self-partition of a single nucleus, no matter how near a neighbor of another kind it may have, nor what that neighbor is. The only reciprocal influences exerted are such as might come from soil or from physical conditions.

If we cannot say that protoplasm is the physical basis of life from the reasoning that the latter is something apart from material substance, we must attribute to this seemingly unorganized, unstable something all those properties and activities which distinguish living things from dead bodies. All that plants do as living things, protoplasm does. Do they select and assimilate food and bring dead matter into the bonds of vitality? Do they manufacture organic substances—starches, sugars, oils, spices, fibers, etc.? Are they sensitive or do they possess irritability? Are they capable of response to stimuli by movement or otherwise? Have they the power of growth and of reproducing their kind? Then protoplasm is present and is performing its wonderful operations.

T. J. Burrill.

PRUMNÓPITYS. See *Podocarpus*.

PRUNE. Prunes are the dried fruit of certain varieties of plums (Fig. 1963). Any plum that can be successfully cured, without removing the pit, into a firm, long-keeping product, may be used for making Prunes. The chief requisite for a good Prune-making plum is that it have a large proportion of solids, more particularly a large amount of sugar. Prunes are much valued in cookery, making a nutritious food having demulcent and laxative qualities. Extra fine Prunes are sometimes called prunelles; these are often packed in mass as are dates and are sold as a confection.



1963. Prunes (× nearly ⅓).
California Prune on the left (Imperiale Epineuse); common commercial on the right.

Until within the last decade, France was the leading Prune-producing region of the world; now first rank must be given to California. The average yearly output in that state for the last five years of the nineteenth century would be about 85,000,000 pounds, with a capacity at the close of the period to produce an average crop of 130,000,000 pounds. France ranks second, with a yearly average for the period given above of about 70,000,000 pounds, a capacity which is being increased but little. The Pacific northwest, Oregon, Washington and Idaho, is third in importance in the Prune industry with a producing capacity at the end of the century of about 30,000,000 pounds per year; this will be considerably increased from year to year. Bosnia, Servia, Germany and Spain are other Prune-producing countries. The most highly reputed Prunes come from the valley of the Loire in France, but it is doubtful if these are superior in quality to the best grades from California and the Pacific northwest.

Attempts have been made to start the Prune industry in many regions other than those mentioned, but although it has not been found difficult to grow the trees and produce an abundance of fruit, the climatic conditions have proved too unfavorable for curing the product, and the attempts have for the most part failed. Notable exceptions are parts of Australia and South Africa, regions which may some time compete with those mentioned above.

The growth of the Prune industry in America is one of the most remarkable industrial phenomena of agriculture. An attempt was made by the United States Patent Office to start the industry in 1854 on the Atlantic coast by the distribution of cions of Prune d'Agen and Prune Sainte Catherine, but though the fruit was produced it could not be cured, and the infant industry soon died. In 1856, Louis Pellier, of San José, California, had shipped from Agen, France, cions of the Prune d'Agen. The fruit was small, and to distinguish it from a larger plum, the Hungarian, supposed to have come from Agen, this was called the Petite, the name now most commonly given to this the leading Prune of the country. The first cured Prunes were exhibited at the California State Fair in 1863. The first commercial orchard was planted in 1870. In 1880 the output per annum was about 200,000 pounds; in 1890 16,000,000 pounds, 80 times as great as in 1880, and now, in 1900, the average capacity is certainly not less than 130,000,000 pounds, valued by the producers at $4,550,000.

There are three methods of curing Prunes: sun-drying, as is practiced in California and some parts of Europe; curing in evaporators, the method in vogue in the Pacific northwest and parts of California; third, sun drying or evaporating after the fruit has been partially cooked, chiefly practiced in the European countries. Without doubt sun-drying is the most economical and profitable process where proper climatic conditions prevail. Some think that a better product may be produced by the use of evaporators, the slight chemical changes taking place more perfectly, so that, as a rule, the fruit looks better, keeps longer, is not so tough, and has a more natural flavor than the sun-dried Prune. The half-cooking is but little advocated in the more progressive Prune regions, for the reason of economy; the product is much darker colored, more tender, and perhaps more palatable, having a cooked flavor liked by many. In California, evaporators are not now used in the leading Prune districts.

The method of treatment in curing Prunes varies greatly, but in general it would be about as follows: The fruit is allowed to remain on the trees until ripe enough to fall to the ground, the maximum proportion of solids being then produced. It is then passed over graders in order to remove all rubbish and to secure several sizes, evenness in size being essential to attain uniformity in curing, since the small fruits dry more rapidly than the large ones. Machines run by hand or by power do the grading. Before going to the drying grounds or to the evaporators the green product must be dipped in boiling lye or pricked by needles in a pricking machine, to check and make tender the tough skin, thus allowing the moisture more readily to escape. The first method is in most general favor. The dipping consists of immersing the fruit for a minute or less in a solution of lye in the proportion of one pound of commercial lye to from ten to fifty gallons of water maintained at the boiling point. The fruit is carried mechanically, as by an endless chain, through a vat, or is placed in wire baskets for the dipping. After a thorough rinsing the Prunes are placed on wooden or wire-bottomed trays and are then ready for the ground or for the evaporator.

In the sun the time of exposure varies from five to twelve days, depending upon the climatic conditions, the size and the variety of the fruit. Treatment in an evaporator varies with the make of the machine. In general, the temperature in the evaporator should be from 120° to 140° at the start, to be increased to from 160° to 180° when the Prunes are taken out. Too much heat at first causes the cells of the fruit to burst, producing drip and discoloration. Other important factors entering into the process of evaporation are the circulation of air in the machine, convenience and cost of fuel and power. The time required for curing ranges from 12 hours for a small, heavy Prune to 48 hours for a large, juicy one. Much depends on the machine. A common fault is to hasten the process too much. If not cured enough, fermentation and mold result; if too much, the weight is lessened, the quality is injured, the Prune is harsh and coarse, and has a dried-up appearance.

When sufficiently dried the Prunes are put in bins or piles to sweat, which takes from one to three weeks; they are then ready for the finishing processes—grading and packing. In grading, the Prunes are separated into sizes indicating the number of Prunes required to make a pound, as 30s to 40s, 40s to 50s and so on to the smallest size, 120s to 130s. Processing is done by dipping the Prunes in boiling water and glycerine, or by steaming, or by using some special preparation in the final dip, or by rattling in a revolving cylinder. Processing is reputable if it adds beauty to the color, or kills insect eggs, or sterilizes the Prunes; it is disreputable when the object is to secure weight. Packing is an art which must be learned by experience and is varied to suit the taste of producer and consumer. The best Prunes are packed in boxes, though much of the product is put up in sacks. Lining with paper, filling, facing, pressing and labeling are important details. A well-cured Prune is soft and spongy, the pit is loose but does not rattle; the skin is bright, lively and free from drippings and exudations; the flesh should be meaty, elastic, and of bright color.

All light-colored Prunes are bleached with sulfur fumes. The process injures the quality of the Prunes, and makes the product somewhat poisonous, but the market is sometimes better for a light-colored, sulfured Prune than for the darker unsulfured ones. In other cases, however, the dark Prunes find the best market. The sulfuring is done by placing the trays of fruit, cured or uncured, in a small chamber in which sulfur is ignited by hot coals, or otherwise, the fumes distributed by ventilators, and the fruit allowed to be fumigated for from a half hour to two hours.

In curing, if all conditions are not right, several difficulties are encountered. In a poor evaporator, the fruit drips, i. e., a syrupy liquid oozes from the Prunes in the process of curing. If a poor product is produced, or if the conditions for keeping are poor, the Prunes become covered with globules of sugar, rendering them sticky and destroying the luster—called sugaring. Fruit grown on poor soil, or on unhealthy trees, or picked before ripe, may cure into small Prunes of an abnormal shape, called "frogs;" or they may ferment and swell up in large, soft Prunes called "bloaters."

VARIETIES.—There is much confusion regarding the nomenclature of the Prune-making plums. In the seat of the industry the green fruits as well as the cured are called Prunes, and the names of the varieties are in many cases different from those given in other than the Prune-producing regions. For several of the leading Prunes there are a number of synonyms, and some sorts have not a few distinct races. Each region, as a rule, has a favorite sort grown almost to the exclusion of all others. The following is a discussion of the varieties of Prune-making plums now well known in America.

Petite Prune (syns., Prune d'Agen, Prune d'Ente, French, California, Robe de Sergeant, etc.).—Of medium size, egg-shaped, violet-purple; flesh greenish yellow, sugary, rich; trees hardy, very prolific, sure bearers. Well cured, it is of a lively, bright amber color. This is the Prune most widely grown in California. It has a large proportion of solids, cures the easiest of any Prune, and shrinks but little in curing. In cooking, but little sugar is needed; hence it is the poor man's Prune. There are several types of this variety, differing mostly in size and shape, due largely to varying soils and climates. It is at present the favorite in the market.

Italian Prune (syns., Fellenberg, German Prune, Swiss Prune).—Large size, oval, dark purple; flesh yellowish, juicy, subacid, delicious; trees somewhat tender, subject to disease, capricious bearers. Cured, the fruit is very dark red, approaching black in color. This is the leading sort in the Pacific northwest, more than four-fifths being of this variety; but it is now found that it is difficult to grow, and that, while a better sort has not yet been found for that region, yet one that would produce as good a fruit without the weaknesses of the Italian tree is very desirable.

Silver Prune (syn., Coe Golden Drop). Very large, oval, one side enlarged, necked, light yellow, dotted with red; flesh yellow, firm, juicy, sweet, rich; tree precarious grower, but very productive when all conditions are favorable. Properly cured, the Silver is of a beautiful golden hue. The cured product is larger than that of any other variety, is of superior flavor, and brings the highest market price. Must be bleached. Always in demand as a fancy product.

Most of the other varieties now grown are sold when cured as one of the above three varieties. All black Prunes are sold as Italians; all amber ones as Petite; and all light-colored ones as Silver. The Italian will usually grade three or four sizes higher than the Petite, and the Silver two or three sizes higher than the Italian. The price paid the producer is usually from one-tenth to one-half cent greater for each higher size. Extras, as the very large sizes of any variety are called, command an additional premium. The following is a list of plums grown more or less for Prune-making: Green Gage, which makes a fancy product; Yellow Egg, sells as the Silver when evaporated; German Prune, a class name for several races making a product much like the Italian; Hungarian Prune, a very large sort making a fancy product, but hard to cure; Robe de Sergeant, much like the Petite and considered the same by some; Bulgarian Prune, of the Italian class; Tragedy Prune, a very early sort of the Italian type; Golden Prune, much like the Silver and possibly better; Champion Prune, an early strain of the Italian. The Willamette, Pacific, Tennant, Steptoe, and Dosch, are all of the Italian type; the Dosch has much to recommend it as a substitute for the Italian. St. Martin's Quetsche is a late sort which sells as the Silver, as do also the Brignole and Datte de Hongrie. The Giant, one of Burbank's seedlings, is much like but larger than the Petite. Imperiale Epineuse is popular in California (Fig. 1963). Sugar Prune, one of Burbank's seedlings, is also becoming popular.

See also *Plum* and *Evaporation of Fruits*.

U. P. HEDRICK.

PRUNÉLLA. See *Brunella*.

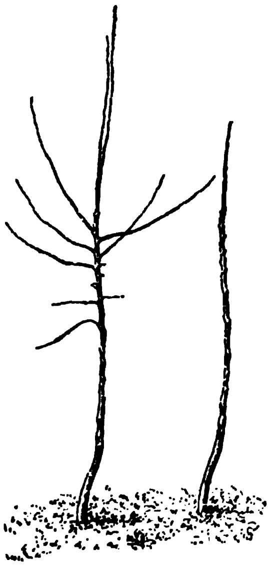
PRUNING. Under this denomination are comprised a multitude of practices and ideals. It is impossible to give any advice for pruning until one has analyzed the subject and knows the objects for which he is to work and the underlying principles on which his practices must rest. The larger part of the writing on pruning gives mere advice or directions, or details some person's experience, without analyzing or elucidating the subject. The practice must differ with every person and every condition: the principles are universal. The ideals that are associated with pruning may be grouped around three centers: (1) pruning proper, or the removal of a part of a plant for the purpose of bettering the remaining part or its product; (2) training, or the disposition or placing of the individual branches, a practice which is ordinarily coincident with pruning proper; (3) trimming, or the shaping of a plant into some definite or artificial form.

1964. More limbs have perished than have survived.—Nature's pruning.

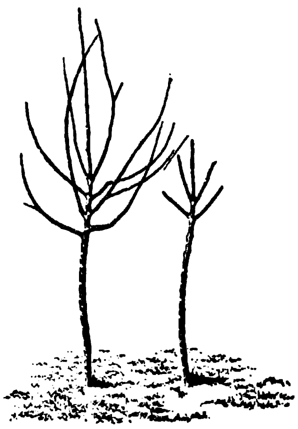
The principles that underlie pruning proper may be associated with two ideals—the lessening of the struggle for existence amongst the parts of a plant, and the cutting away of certain parts for the purpose of producing some definite effect in the formation of fruit-buds or leaf-buds or in modifying the habit of the plant. There are more branches in the top of any plant than can persist; therefore there is struggle for existence. Those which have the advantage of position, persist. Nature prunes. Dying and dead branches in any neglected tree-top are illustrations of this fact. Whenever the struggle for existence is greatly lessened, the remaining branches receive a greater proportion of the plant's energy, and they therefore make stronger growth or are more productive in flowers and fruit. Pruning is essentially a thinning process.

In itself pruning is not a devitalizing process; it is only devitalizing when it is carried to excess or when the wounds do not heal and disease sets in. It is rather an invigorating process, since it allows more nourishment to be distributed to the remaining parts of the plant. The notion that pruning is devitalizing arises from false analogy with animals, which suffer shock or injury when parts are removed. The fact that pruning is not a devitalizing process is proved by every tree. The tree is a record of successive prunings. Note the number of branches on the seedling tree in the nursery row or in the forest, and then consider that all these branches, with the exception of the leader itself, will probably perish in the course of time. The forest tree develops a bole because the side limbs are pruned away by natural causes. Fig. 1964. Knots are records of nature's pruning. In the greater number of cases the limbs die and are removed when still very young, and they leave small record in the grain of the wood; but all visible knots are histories of the removal of large branches. As a rule, it is only when the knots become knot-holes that injury results. A knot-hole means decay, and this decay may extend into the heart of the tree, finally causing it to become hollow. A black or decayed heart is always an indication of disease. The disease originates on the outside of the plant: it is the result of inoculation. This inoculation takes place through some bruised or broken part; it is usually an inoculation of filamentous fungi. These fungi gain a foothold in the dead and dying cells of the wound, and as they grow they are able to destroy the living cells and therefore to produce decay. The larger the wound, the greater is the liability to infection. It is very important, therefore, in the pruning of trees, that the wounds shall be as small as possible. This means that the best pruning is that which is practiced annually, so that none of the branches to be removed attain large size. This annual pruning is also most desirable for other reasons, as may be seen below.

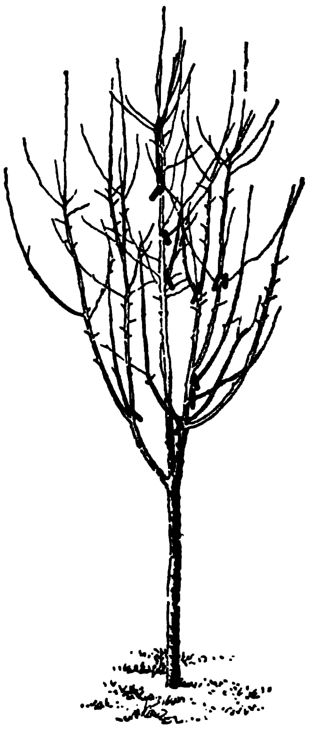
Woody plants should always be pruned when they are transplanted. This is because the roots are pruned in the very process of removal, and the tops should be reduced in proportion. For some time after the plant is transplanted, it has no vital connection with the soil, and if all the top is allowed to remain there is much evaporation from it and a dissipation of the energies of the plant. How much of the top shall be removed depends on how much of the roots was removed in digging, and also on the personal ideals and desires of the operator. It is a general practice to cut back the top of a plant at least one-half upon transplanting; in some cases still more of the top is removed. Quite another question is the particular form in which the top shall be left. Some growers prefer to remove all side branches, if it is a fruit tree, and leave a straight whip. Fig. 1965. They are then free to start the new branches where they like. This is the better practice with very young trees, and it is one that is nearly always employed with peach trees. If the trees are three years old and well branched, most persons prefer to leave three or four of the main branches to form the starting point of the future top. Fig. 1966. These branches may be headed back half or more of their length. Of late years a method of very severe pruning has come into notice under the name of the Stringfellow or stub-root system, taking its name from H. M. Stringfellow of Texas, who has written much concerning it. The fullest presentation of Mr. Stringfellow's ideas will be found in his book, "The New Horticulture." It advises that practically all the roots be cut away and that the top be shortened to a straight stick one or two feet long, without side branches. It is the supposition that when trees are reduced to their lowest terms in this way, the new root-branches that arise will take a more natural form and the tree will assume more of the root character of a seedling. This method of transplanting has met with good success in many places. The fundamental theories on which it is founded, however, have not been demonstrated. This system is, in fact, a matter of local practice rather than of principle. In a great majority of cases, it will be found to be better, particularly in trees that are three years or more old, to prune them only moderately, allowing a part of the original root system and a part of the top to remain.



1965. Pruning at time of transplanting.



1966. Pruning of the young tree on transplanting.



1967. Young apple tree. The marks show which limbs may be removed to advantage.

Pruning Fruit Trees. — Fruit trees are pruned for the purpose of enabling them to produce a superior quality of fruit. They are not pruned primarily to make them assume any definite or preconceived shape. It is best, as a rule, to allow each variety of tree to take its own natural or normal form, only pruning it sufficiently, so far as shape is concerned, to remove any unusual or unsymmetrical growths.

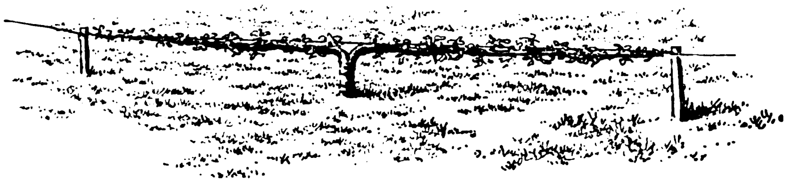
(1) The fundamental conception in the pruning of fruit trees is to reduce the struggle for existence, so that the remaining parts may produce larger and finer fruits.

(2) The result of pruning fruit trees should be to keep the tree in bearing condition, not to force it into such condition. If the tree has received proper care from the time it is planted, it should come into bearing when it reaches the age of puberty. Pruning, therefore, is merely a corrective process and keeps the tree in proper bearing condition. When trees have been much

neglected, pruning may be the means of reinvigorating them and setting them into a thriftier condition. In such cases it is one of the means of renovating the tree, as tilling, fertilizing and spraying are.

(3) Heavy pruning of the top tends to produce wood. This is because the same amount of root energy is concentrated into a smaller amount of top, thereby causing a heavier growth. This is particularly true if the pruning is done when the plant is dormant.

(4) Heavy pruning of the root tends to lessen the production of wood, because the same amount of top receives a less supply of soil water with its content of plant-food.

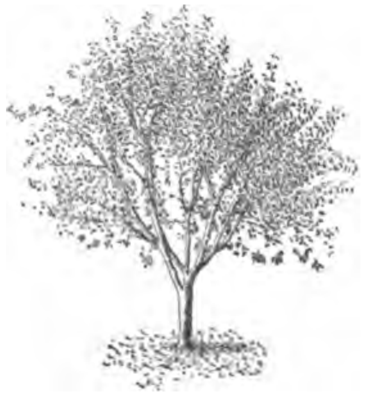


1969. Cordon training.

An apple tree (grafted on dwarf stock) trained in two branches on a horizontal wire running only two feet above the ground. Each year the growths are cut back to spurs.

(5) Trees which grow much to wood are likely to be relatively unproductive. It is an old maxim that checking growth induces fruitfulness, so long as the plant remains healthy. If the tree is thrown into redundant growth every two or three years by very heavy pruning, it tends to continue to produce wood at the expense of fruit. When a tree is to be brought into bearing condition by general good treatment, the aim should be to keep it in that condition by a relatively light annual pruning. Violent pruning is allowable only when trees have been neglected and it is necessary to bring them back into bearing condition or to renew their tops.

(6) The operator should know where the fruit-buds are borne before undertaking the pruning of any fruit tree; otherwise he may destroy too many of them. If he knows the position of the fruit-buds, he may prune in such manner as to thin the fruit even without the removal of much wood, and thereby to reduce the struggle for existence to a minimum. Every species of tree has its own method of fruit-bearing. The pear bears its fruit largely on old spurs. The peach bears on the wood of the last season's growth. In order to thin the fruit of the pear by pruning, therefore, it is necessary to remove part of the spurs. In the peach it is necessary to cut out or to cut back a part of the previous year's growth. Each species of plant is a law unto itself in these regards.



1968. A New York cherry-grower's ideal of a Montmorency cherry tree.

Perhaps the large branch on the front side should have been removed when the tree was young.

(7) Heading-in tends to promote fruitfulness, particularly in those trees that are growing over-rapidly. If the heading-in is very severe, however, it may amount to a heavy pruning, and in that case it may set the plant into wood-bearing rather than into fruit-bearing. It is not to be supposed, however, that heading-in is necessarily to be advised in order to make trees bear. They may bear just as well if they are never headed-in, provided they are otherwise well pruned and well cared for. Whether one shall head-in his fruit trees or not, is a personal question. If the trees are growing too rapidly, it is well to head them in in order to check their ambition. This is particularly necessary when trees are growing on heavy or very fertile soil and tend to overgrow. In such case, cutting off the strongest leaders and leaving the weaker ones may induce greater fruitfulness. When trees are planted too close together, it may also be necessary in order to prevent the plantation from becoming too thick. Some people like a low-headed and rounded top; this is a question of personal ideals. If the orchardist desires such form, it is necessary to head-in the tree. It should be remembered that the more a tree is headed-in the thicker it tends to become in the crown and the more inside pruning is necessary. Whenever there is danger of fruit rot, as in plums and early peaches, it is a question whether the thick form of top is the most advisable.

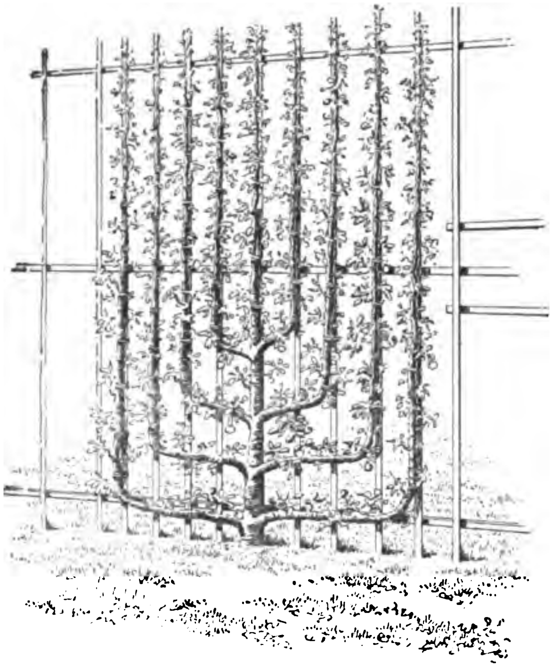
(8) Pinching-in the annual growths in early summer tends to augment the development of fruit-buds, although these buds may not be developed the very year in which the pinching-in is done. This is a special practice, however, which can be employed only on small areas and with particular trees. It is essentially a garden practice and not an orchard practice. In the orchard, one must depend for fruitfulness upon the general good care of the plantation, and in this care pruning is one of the essential factors.

(9) Pruning fruit trees usually resolves itself into a thorough and systematic thinning out of the weak, imperfect and interfering branches. Thereby, the energy of the plant is saved and is deflected to those parts that are capable of bearing a useful product. The sun and air are admitted. The tree becomes manageable for spraying and for picking. All the fruits have an opportunity to develop. How much or how little to thin is wholly a local question. In humid climates, much thinning may be necessary. In dry, hot climates, as on the Plains, but little thinning is allowable, else the branches may sun-scald. Figs. 1967 and 1968 illustrate two pruning ideals. Consult, also, the pictures in the various fruit articles in this work.

(10) Scraping the rough bark from old trunks may be a desirable practice, since it destroys the breeding places of insects and fungi. Trees that have been continuously thrifty, however—that have received uniformly good tillage, fertilizing, pruning, spraying—rarely need to be scraped, as the bark remains relatively smooth and firm. Only the loose outer bark should be removed. On ornamental trees, the bark is a part of the characteristic beauty, and it should not be scraped. Although not a pruning question, this is closely associated with pruning practices.

Pruning Ornamental Plants.—Ornamental trees and shrubs are pruned for three purposes: (1) to enable them to produce greater quantity of bloom; (2) to make them take some desired form; (3) to remove unusual or straggling growths.

The pruning of ornamental trees and shrubs for the production of flowers is controlled largely by the flower-bearing habit of the plant. Most early-blooming plants develop their flower-buds the year before. Heavy pruning, therefore, particularly heading-in, when the plants are dormant, cuts off the flower-buds and the amount of bloom is lessened. If these plants are pruned just after the flowers are passed in spring the best results will be secured, since the new growths will then develop flower-buds for the year following. It may be advisable, however, to prune such plants in winter for the purpose of thinning them, thereby allowing the flower-buds which remain to produce larger bloom.



1970. Apple tree trained on an espalier.

In most ornamental plants, however, it is the number of flowers rather than the size of each which is desired.

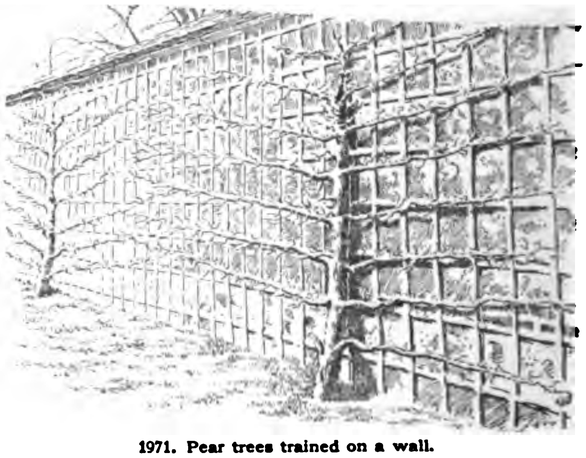
Plants that bloom late in the season, like hydrangea and most species of clematis, make their flower-buds on shoots which arise that very season. With such plants, it is well to prune rather heavily while they are dormant in order to cause them to throw up a profusion of strong shoots in the spring. These shoots will bear that summer. Lists of plants in these two categories will be found in the appendix to the second edition of "The Pruning-Book."

Pruning to make the plant assume some definite form is essentially a method of shearing or heading-in. If it is desired to have a very regular and definite shape, it is well to shear the plant at least two or three times a year in order to keep down the exuberant growths. It is a common practice to shear the plants only in the winter, but if this shearing is somewhat violent, as is usually the case, the plant throws up numerous strong shoots very early in spring and it remains shapeless during a large part of the growing season.

Training.— There is relatively little careful training of plants in North America, largely because of the expense of the skilled labor which is necessary to perform it. Land is also relatively cheap, and room can be given for the natural development of most plants. In the Old World, fruit plants must be grown in very small areas, and it may be necessary to train them on walls, sides of buildings, or on trellises of various kinds. Trained fruit trees may generally be referred to one of three categories: the wall tree, which is trained against a continuous surface; the espalier, which is trained on a trellis, the branches starting at nearly right angles from a central shaft; the cordon, or training to a single or double strand near the ground. Properly, an espalier is a trellis; but the word is commonly used for the plant that is trained on the trellis. There are many variations in the methods of training and pruning in each of these three classes, and the methods are such as can scarcely be well elucidated in writing. The Old World literature is replete with instructions. In recent American literature, the fullest account is to be found in "The Pruning-Book." In order that trees may be well trained on walls, espaliers and cordons, it is necessary that the training be begun in the nursery. The Old World nurseries grow plants which are trained for various uses, but the American nurseries do not. If, therefore, the American is to train trees in any of these formal shapes, he should secure specimens that are not more than one year from the bud or graft, and begin the training himself. The illustrations (Figs. 1969–71) suggest some of the special methods of training fruit trees.

When to Prune.—It will be gleaned from the above remarks that the time of pruning depends on many circumstances, and chiefly on the result which it is desired to reach. So far as the healing of the wound is concerned, it is usually best to prune when the vegetative activities begin in spring so that the wound is quickly covered or "headed." For the purpose of checking growth and producing other definite results, it may be necessary to prune at other times of the year. As a general rule, however, the best time to prune is in late winter and early spring, when labor can be had and before the rush of spring work comes on. The colder and drier the winter climate, the later the pruning should be delayed.

The wound made by severing a branch heals by means of a callus which forms from the growing tissue between the bark and wood. Fig. 1972. This tissue rolls over the wound, finally joining in the center and completely covering the old wood. The old wood itself takes no part in the healing process; in fact, it dies. When the healing is complete, the old wood is merely covered and preserved from external injury and infection, much as fruit in a jar is preserved by being protected with a cover. There is no dressing that will hasten the healing process except as it keeps the wood from decay. In other words, the whole object of dressing a wound is to protect it. The dressing prevents bacteria and fungi from securing a foothold and thereby prevents the rot. Wounds that are exposed for some years nearly always become unsound at the center because of the intrusion of these organisms, and even if the wounds should subsequently heal over, the infection may still extend down the heart of the tree and finally cause its death. The best covering for a wound is one that protects it best from microbes and fungi and which persists the longest. Ordinarily, good white lead paint, applied heavily and renewed occasionally, is the best protection. Grafting wax may afford a good protection, if it is applied hot so that it soaks into the tissue. If it is merely spread over the surface, it soon blisters and becomes loose and affords relatively little protection.

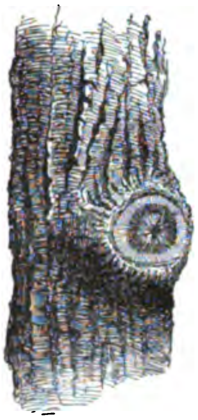


1971. Pear trees trained on a wall.

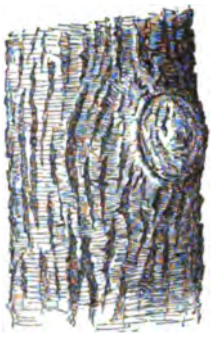
When once the wall is covered, the tree is never allowed to increase in surface area. It is cut back to spurs each year, much as grape-vines may be treated.

The rapidity with which wounds heal depends very largely on their position on the tree and the way in which they are made. Wounds along the main branches, which are the leading avenues for distribution of food, heal more speedily than those on the weaker side branches. The closer the wound sits to the branch, the more quickly will it heal. Fig. 1973. If a stub is left several inches long (Fig. 1975), it seldom heals until it rots back to the main branch or trunk; and by that time the decayed heart may have extended deep into the tissue of the tree. It is a common notion that a limb should be cut at right angles to the direction of the limb itself and beyond the bulge at its base. It is a better plan, however, to make the wound parallel to the direction of the branch or trunk that remains, and close to it. This wound may have a somewhat larger superficial area, but it is much nearer the source of the healing food supply and therefore becomes covered more quickly.

L. H. B.

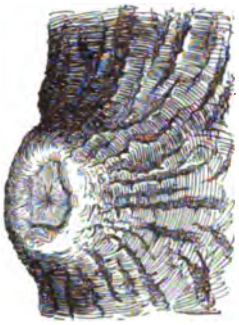


1972. The healing tissue arises from the side of the wound, not from the hard wood.

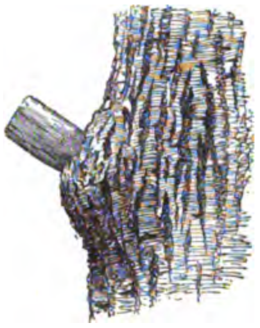


1973. A well-covered wound.

The pruning was properly done, no stub being left.



1974. The stub is longer than necessary, although the fault is not a flagrant one.



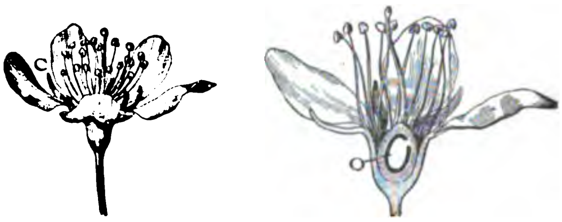
1975. Common fault in pruning.

This wound cannot heal until the stub rots away, and by that time the tree may be irreparably diseased.

PRÙNUS (ancient Latin name of plum). *Rosàceæ.* PLUM, CHERRY, PEACH, APRICOT, ALMOND, etc. About 75 species of pink-flowered or white-flowered shrubs and small trees of wide distribution, but most abundant in the north temperate zone. Lvs. alternate, simple, usually serrate: fls. mostly in spring, sometimes preceding the leaves, either solitary or in clusters, perfect, the pistil single, the stamens numerous and perigynous, the petals and calyx-lobes 5: fr. a drupe, usually 1-seeded by the abortion of one of the two ovules. Fig. 1976. The genus as here outlined includes several well-marked groups, some of which are regarded as distinct genera by many authors. In their extreme or typical forms, these subgenera are very distinct, but there are so many intergradient forms that it seems unwise to keep them distinct as genera. The tendency of plant-breeding is to still further obliterate the differences by means of hybridization. At best, the genus is polymorphous, but the general experience is that confusion is increased rather than decreased by the effort to make two or more genera from it. Many of the forms that appear to be very distinct in their extremes, connect by insensible gradations in intermediate ranges. The dominant East American species, for example, shade off into marked forms in the West and Southwest (see Waugh, 12th Rep. Vt. Exp. Sta., p. 231-239).

Horticulturally, Prunus is one of the most important of all genera. It includes the stone-fruits,—peaches, plums, cherries, apricots, almonds. It is also prolific of ornamental subjects, as double-flowered, variegated-leaved, colored-leaved and weeping forms. Most of the cultivated species are hardy in the latitude of Philadelphia and many are hardy in Ontario. All are of easy culture. Nearly all the species are spring-flowering. Only *P. acida*, amongst the cultivated kinds, blooms as late as midsummer. They are very useful for spring gardens, therefore, where they make great display, but their short season of bloom and the very ordinary foliage of most of them have limited the planting of the ornamental kinds. Some of the ornamental species are not grown on their own stocks, but are worked on stocks that can be grown easily and cheaply and of which seeds can be obtained in abundance. The commonest stocks for the ornamental kinds are the plum (*P. domestica*), peach and sweet cherry. On the plum are grown the dwarf almonds and the double-flowering and fancy-foliage plums. The myrobalan plum (*P. cerasifera*) is sometimes used for the same purpose. Peach stocks may be used for the same species, as a rule; and they are also employed, particularly in the South, for many fruit-bearing plums. The sweet cherry (*P. Avium*) is a good stock for the various kinds of double-flowered, weeping and fancy-leaved cherries. It is an important point in the growing of these grafted Prunuses to remove all sprouts from the stock as soon as they appear. This is particularly true of the dwarf almonds, since the stocks are usually stronger-growing species and tend to sucker from the root. It is a question whether it would not be better to propagate these dwarf species from layers or cuttings in case seedlings of their own species cannot be had. Own-rooted plants can be secured by root-grafting with a long cion (see Fig. 943, Vol. I).

In North America there has been a most remarkable contemporaneous evolution of fruit-bearing plums from the native species. Several hundred orchard varieties have been described, and the trees are grown commercially over a wide range of country in the South, in the Mississippi valley and on the Plains,—in regions in which the common *Prunus domestica* does not thrive. Systematic knowledge of these domesticated native plums dates from 1892 (Bull. 62, Cornell Exp. Sta.).



1976. Flowers of plum. Natural size.

The ovary, or young plum, with the ovule inside, is at *o*.

For the latest knowledge of the subject, the reader should consult experiment station literature, particularly the writings of Waugh and Goff. See, also, "Evolution of our Native Fruits."

For fuller information on the fruit-bearing members of the genus, see *Almond, Apricot, Cherry, Nectarine, Peach, Plum, Prune.*

INDEX TO THE LATIN NAMES.

acida, 28.
acutifolia, 5.
Alberti, 31.
Allegheniensis, 11.
Americana, 10.
Amygdalus, 41.
angustifolia, 14, 27, 32, 33.
argentea, 40.
Armeniaca, 1, 2, 3.
ascendens, 24.
asplenifolia, 27, 29.
atropurpurea, 5.
aucubæfolia, 31.
aurea, 31.
austera, 28.
Avium, 27.
Bertini, 33.
Besseyi, 16.
Bigarella, 27.
Brigantiaca, 1.
camelliæflora, 42.
camelliæfolia, 33.
campestris, 37.
Capollin, 29.
Caproniana, 25, 28.
Capuli, 29.
Caroliniana, 34.
Carthagena, 29.
cartilaginea, 29.
Caucasica, 33.
cerasifera, 5.
Cerasus, 28.
Cereola, 7.
Chamæcerasus, 18.
Chicasa, 14.
Cochinchinensis, 37.
Colchica, 33.
communis, 7, 41.
commutata, 31.
cuneata, 16.
Damascena, 7.
dasycarpa, 3.
Davidiana, 43.
Decumana, 27.
demissa, 30.
divaricata, 5.
domestica, 5, 7.
donarium, 25.
Duracina, 27.
emarginata, 22.
fruticosa, 18.
Galatensis, 7.
Georgica, 37.
glandulosa, 13.
gracilis, 13.
Gravesii, 13.
Grayana, 31 and suppl. list.
Hattan, 8.
heterophylla, 27.
hortensis, 25.
hortulana, 15.
ilicifolia, 35.
incana, 36.
injucunda, 12.
insititia, 7.
integrifolia, 35.
Italica, 7.
Itosakura, 24.
Japonica, 33, 38.
Japonica, Hort., 8, 18, 24, 25.
Juliana, 27.
Kelloggii, 9.
lævis, 42.
Lannesiana, 25.
latifolia, 33.
Laurocerasus, 33.
Lindleyi, 39.
Lusitanica, 32.
macrocarpa, 41.
macrophylla, 27.
Mahaleb, 20.
maliformis, 7.
maritima, 13.
marmorata, 31.
microphylla, 33.
Mineri, 15.
mollis, 10.
Mume, 4.
Myrobalana, 5.
myrtifolia, 32.
nana, 30, 37.
necturina, 42.
nicotianæfolia, 27.
nigra, 10.
occidentalis, 35.
œconomica, 7.
orientalis, 40.
orthosepala, 15.
Padus, 31.
paniculata, 25.
pedunculata, 39.
pendula, 18, 24, 27, 29.
Pennsylvanica, 21.
Persica, 42.
persicæflora, 28.
Petzoldi, 39.
Pissardi, 5.
Planteriensis, 5.
platycarpa, 42.
Pseudo-Cerasus, 25.
Puddum, 25, 26.
pumila, 16.
pumila, Hort., 18, 38.
pyramidalis, 27.
ranunculiflora, 28.
reflexa, 18.
regalis, 27.
Rhexii, 28.
rivularis, 15.
rosea, 24.
rotundifolia, 33.
salicifolia, 27, 29, 30.
Schipkaensis, 33.
semperflorens, 23.
serotina, 29.
serratifolia, 25.
serrulata, 25.
Sibirica, 2.
Sibirica, Hort., 18.
Sieboldi, 25.
Simonii, 44.
Sinensis, 38.
spinosa, 6.
subcordata, 9.
subhirtella, 24.
Syriaca, 7.
Texana, 10.
tomentosa, 19.
triflora, 8.
triloba, 39.
umbellata, 12.
Utahensis, 17.
variegata, 18, 28, 29.
virgata, 39.
Virginiana, 30.
vulgaris, 28, 42.
Watereri, 25.
Watsoni, 14.
Waylandi, 15.

Focke (Engler & Prantl, Pflanzenfamilien) makes 7 subgenera in Prunus, 5 of which may be admitted here:

A. *Lvs. convolute in the bud (i. e., rolled up, showing well as the lvs. begin to emerge from the bud): ovary usually furrowed lengthwise.* There are exceptions in some of the American native plums (Nos. 10, 11, 14, 15) in which the lvs. are conduplicate in vernation: these species and their allies are intermediate between the true plums and the cherries .... I. PRUNOPHORA (Nos. 1–15)
AA. *Lvs. folded or conduplicate (trough-shaped, folded lengthwise along the midrib) in the bud.*
  B. *Fruit very juicy, glabrous or only very slightly hairy: stone smooth or roughish.*
    C. *Fls. in fascicles or cymes* .... II. CERASUS (Nos. 16–28)
    CC. *Fls. in racemes* ...... III. PADUS (Nos. 29–35)
  BB. *Fruit normally soft-hairy (except in 42 var.): stone or pit often furrowed and pitted.*
    C. *Flower-cup (usually called calyx-tube) tubular* .... IV. CHAMÆAMYGDALUS (Nos. 36–37)
    CC. *Flower-cup short and wide-spreading* ......V. AMYGDALUS (Nos. 38–44)

For horticultural purposes, these five main groups may be illustrated as follows:

1. *Plums and apricots* .... I. PRUNOPHORA
2. *Common or fascicled cherries* . II. CERASUS
3. *Racemose cherries* .... III. PADUS.
4. *Dwarf almonds* .... IV. CHAMÆAMYGDALUS
5. *Almonds and peaches* .... V. AMYGDALUS

SUBGENUS I. PRUNOPHORA. Apricots and Plums.

Fruit sulcate, glabrous and usually glaucous (except in the apricots), the stone compressed and usually longer than broad and smooth or nearly so: fls. solitary or in umbel-like cymes, mostly appearing before the lvs. or with them: lvs. mostly convolute in vernation, generally ovate or lance-ovate.

A. APRICOTS,—*the fls. solitary or in 2's, before the lvs. and the fr. velvety (at least until ripe): stone usually sulcate on the margin: peduncle separating from the mature fruit.*

1. **Armeniaca**, Linn. (*Armeniaca vulgàris*, Lam.). COMMON APRICOT. Figs. 113–117. Small round-topped tree with reddish bark much like that of the peach tree: lvs. ovate to round-ovate, sometimes slightly cordate at the base, abruptly short-pointed, glabrous (at least above), closely serrate, the stalks stout and gland-bearing: fls. pinkish, solitary and sessile or very nearly so, appearing from lateral buds of last year's growth (sometimes on short year-old spurs) before the lvs.: fr. variable, nearly smooth when ripe, short-stalked like a peach, usually somewhat flattened, mostly yellow and overlaid more or less with red, the stone flat and smooth, ridged or sulcate on one edge. Said by Focke to be native of Turkestan and Mongolia; by some regarded as Chinese. It early reached Europe, where it was once supposed to be native of Armenia, whence the name *Armeniaca*. The Russian Apricot is a hardy race of this species. See *Apricot* and Figs. 113–117 in Vol. I. The smooth-fruited Apricot, *P. Brigantiaca*, Vill., is regarded by Dippel as a form of this species, var. **Brigantiaca**, Dipp. Shrub or small tree, with smaller lvs. and smaller smooth subacid fruit. Probably a cultural variety. Run wild in southern France and Piedmont.

1977. Prunus Sibirica (× ⅓).

2. **Sibirica**, Linn. (*P. Armeniaca*, var. *Sibírica*, K. Koch). SIBERIAN APRICOT. Fig. 1977. Bush or small tree: lvs. ovate to narrow-ovate, long pointed, strongly and often incisely toothed: fls. white or pink, appearing early in the season and usually in great profusion: fr. globular, rarely more than ½ in. in diam., yellow with a reddish cheek, scarcely fleshy, practically inedible. Mongolia, Dahuria. L.B.C. 17:1627.—Sometimes planted as an ornamental bush.

3. **dasycárpa**, Ehrh. (*P. Armeniaca*, var. *dasycárpa*, K. Koch). PURPLE OR BLACK APRICOT. Small tree, of the stature of the common Apricot: lvs. smaller and narrower, mostly elliptic-ovate, finely and closely serrate, thin, dull green, the stalks slender and nearly or quite glandless: fls. large and long-stalked, showy: fr. globular and plum-like on a distinct stem, pubescent at maturity, dark purple, the flesh soft and sourish; stone fuzzy. Probably native to Manchuria. B.R. 15:1243. L.B.C. 13:1250.—Sometimes planted, mostly as an ornamental tree, for the fruit has little value compared to that of the common Apricot. Hardy in the North. Has every appearance of being a distinct species.

4. **Mùme**, Sieb. & Zucc. JAPANESE APRICOT. Fig. 1978. Tree of the dimensions of the common Apricot, but the bark greenish or gray and the foliage duller in color: lvs. relatively small, narrow-ovate to nearly round-ovate, long-pointed, finely and sharply serrate, more or less scabrous, lighter colored beneath, the petíoles mostly gland-bearing: fls. sessile or nearly so, fragrant: fr. mostly smaller than that of *P. Armeniaca*, yellow or greenish, the dry flesh adhering to the pitted stone. Japan, where it is much grown for its flowers. Gn. 50:1081. R.H. 1885:564.—Planted to some extent in the South, particularly in the form known as Bungo or Bongoume Apricot or plum, but of minor value. When top-worked on plum, it withstands the winters of cen-

tral New York, but will not bear. The Apricot cult. as Chinese or Shense is also of this species. Many double-fld. forms in Japan.

1978. Prunus Mume (× ⅓).

AA. PLUMS,—*the fls. mostly in cymes, in most species appearing with the lvs. in the North (before the lvs. in the South), and the fr. smooth and glaucous: stone not prominently sulcate: peduncle slender, remaining with the fruit.*

B. *Eur.-Asian Plums: lvs. relatively broad, usually prominently reticulated and more or less pubescent (at least beneath), the young twigs mostly pubescent.*

C. *Flower-stems glabrous.*

5. **cerasifera,** Ehrh. (*P. doméstica*, var. *Myrobalan*, Linn. *P. Myrobalàna*, Loisel.). MYROBALAN PLUM. CHERRY PLUM. Slender twiggy grower, often thorny, the twigs usually soon becoming glabrous: lvs. rather small and thin, rather light green, becoming nearly or quite glabrous, short-ovate and short-pointed, finely serrate: fls. rather small, white or blush, slender-stalked: fr. small (usually 1 in. or less in diam.), globular and cherry-like, depressed about the stem, yellow or red, the flesh soft, juicy and sweet-flavored. Probably native to the Caucasus and southwestern Asia. B.M. 5934. Gn. 33, p. 252. J.H. III. 28:267.—The Myrobalan Plum is extensively used in this country as a stock on which to bud the domestica Plums, the seedlings being imported in great quantities from Europe. It is a smaller tree than *P. domestica*, with much more slender growth, smoother twigs and leaves, smaller and mostly earlier flowers and smaller, softer fruit with a depression about the stem. It tends to dwarf the domestica Plums, but its influence in this direction is not sufficient to discourage its use as a stock. Its advantages as a stock are its cheapness, the ease with which all domestica varieties "take" on it, and the readiness with which it can be grown in the nursery row. It is not used to any extent as stocks for other Plums than the domesticas. Spontaneous trees are sometimes found about old nursery grounds, and it occasionally appears in orchards when the top of a Plum tree dies and sprouts arise from the root. There are also a few varieties propagated for the early juicy fruits, but they are little known. It makes a good ornamental tree. The Marianna, much used for stocks of many kinds of Plums in the S. (and growing from cuttings), is perhaps a hybrid of this species with *P. hortulana* or *P. angustifolia*. There are several cultivated forms of *P. cerasifera*, one of the best being the plant known as P. Planteriénsis, Hort., with full double white and red fls. There are also forms with yellow- and white-variegated leaves, and a weeping form (var. *pendula*). A form with narrow willow-like lvs. (var. *acutifòlia*) is also advertised. A form with twisted or contorted foliage is shown in R.H. 1895, p. 201.

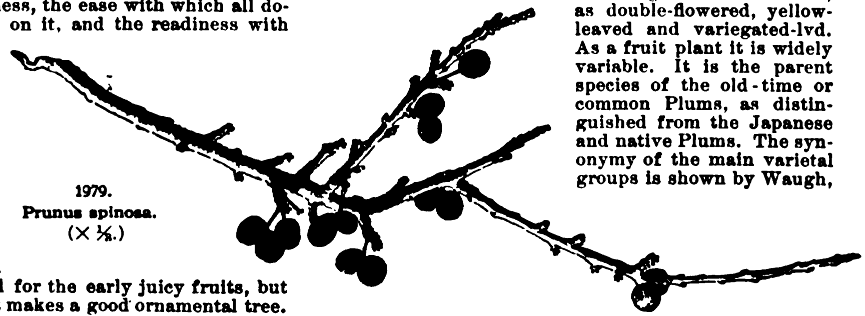
Var. **atropurpùrea,** Dipp. (*P. Pissárdi*, Hort. *P. cerasifera*, var. *Pissárdi*, Bailey). A handsome form with purple lvs. and dark wine-red fruits.—Introduced into France by Pissard, gardener to the Shah of Persia, and first fully described in Revue Horticole in 1881. It is a cultural form of *P. cerasifera*. It is one of the best of all small purple-leaved trees, holding much of its color in the American summers. It seems to be hardy whereever the common Plum will stand. The best color is secured on the strong growths; therefore it is well to head back the tree frequently. R.H. 1881:190; 1884:396. G.C. III. 1:416. Gn. 32:613; 55, p. 314. J.H. III. 28:287. G.M. 31:190–1.

Var. **divaricàta** (*P. divaricàta*, Ledeb.). Branching from the base, the branches wide-spreading and some of them nearly or quite prostrate: lvs. broader towards the base: fr. not depressed about the stem, yellow. Macedonia to N. Persia. B.M. 6519.

6. **spinòsa,** Linn. BLACKTHORN. Fig. 1979. Low and spreading, making a very thick thorny top, the young growths distinctly pubescent: lvs. small, oblong-obovate or elliptic-ovate, very numerous on the branches, nearly or quite obtuse, very finely and closely serrate: fls. white, small, borne singly or in pairs (or sometimes in 3's) and often on the thorns: fr. little larger than a very large pea, very deep glaucous-blue, usually persisting until winter, scarcely edible. Middle and southern Europe and N. Africa to N. Persia and Siberia. —Sometimes planted in this country, chiefly in the double-fld. form (Gn. 59, p. 76). It is an excellent bush or small tree for protecting the borders and corners of drives and walks. The short, stiff, thorny branches make a good barrier. Perfectly hardy where the Plum can be grown. It is not impossible that this species is the original of the domestica Plum. The little fruits are usually astringent, but there is a sweet-fruited form.

CC. *Flower-stems usually more or less hairy.*

7. **doméstica,** Linn. (*P. commùnis*, Huds.). COMMON GARDEN PLUM. Figs. 1851–55. Plate XXX. Strong-growing small tree with pubescent twigs: lvs. large and thick, dull green, much reticulated, pubescent beneath, ovate or obovate, coarsely and irregularly serrate: fls. white, large, usually in clusters: fr. various, but firm in texture and usually not depressed about the stem; stone large, slightly rough or pitted.—Native country unknown, and very likely derived from *P. spinosa*. If it exists in a truly wild state, it is to be sought in the Caucasus and trans-Caucasus regions. It is run wild in many parts of the world. Focke says that *P. domestica* is unknown in an originally wild state, and that the typical form of the species is the prune (Zwetsche), *P. œconomica*, Borkh. There are various forms of *P. domestica* grown for ornament, as double-flowered, yellow-leaved and variegated-lvd. As a fruit plant it is widely variable. It is the parent species of the old-time or common Plums, as distinguished from the Japanese and native Plums. The synonymy of the main varietal groups is shown by Waugh, Bot. Gaz. 26, pp. 417–427 (Dec., 1898), and 27, pp. 478–481.



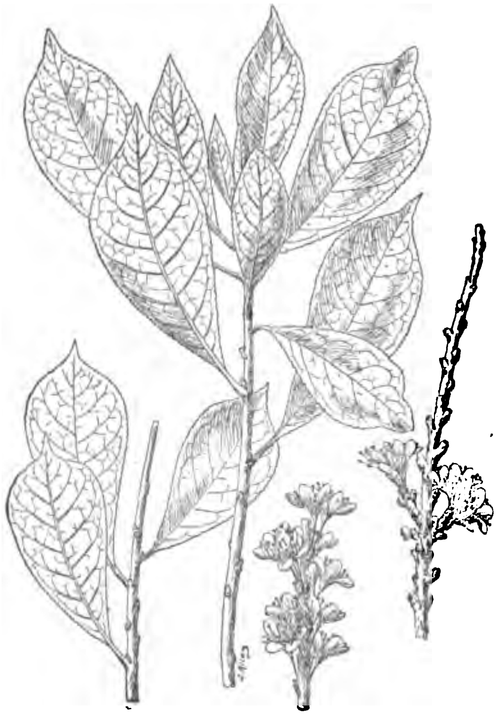
1979. Prunus spinosa. (× ⅓.)

Var. **Damascèna,** Linn. (*P. insitítia*, Linn. *P. Itálica*, Borkh.). DAMSON. Fig. 1856. A form with small foliage and small firm fruits borne mostly in clusters.—Damson is a general name for small-fruited and small-leaved forms of the Plum. When the Plum runs wild it usually reverts to this form. Some of the Damsons (as the French, Shropshire, Farleigh) are commercial orchard varieties, being used for culinary purposes. There is much difference of opinion as to the systematic position of the Plum designated by Linnæus as *P. insititia*, but it is clear that it is intermediate between *P. domestica* and *P. spinosa*. It is probably one stage in the reversion of the Plum towards *P. spinosa*. It seems to be indistinguishable from var. *Damascena*, when this variety is taken in its large sense.

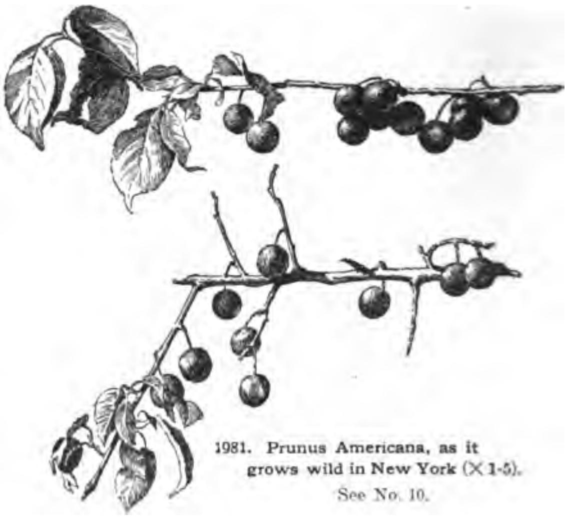
Other forms of Plums have received Latin class-names, as var. **maliförmis**, Linn. (*P. Syrìaca*, Dipp.), including the Mirabelle (a small-leaved form with small yellow fruit, not unlike the Damsons) and others; var. **Ceréola**, Linn., the Green Gages or Reine Claudes; var. **Galaténsis**, Auth., the Prunes.

BB. *Oriental Plums: lvs. relatively longer (mostly oblong-obovate), not roughened or pubescent, often shining, the young twigs glabrous or nearly so.*

8. **triflòra**, Roxbg. (*P. Japónica*, Hort., not Thunb. *P. Háttan*, Tamari). JAPANESE PLUM. Fig. 1980. Plate XXX. Strong-growing small tree, with smooth often shining reddish or cinnamon-brown twigs: lvs. mostly oblong-obovate, abruptly but prominently pointed, closely obtuse-serrate, the veins looping near the margin, bright often shining green above and dull beneath: fls. few from each bud (most commonly about 3), showy, white or very nearly so, slender-stalked: fr. various, mostly large and firm, yellow or light red (never blue-purple) with pronounced suture and tending to be pointed at the apex. R.H. 1895:160.—Probably Chinese, but introduced into this country from Japan (in 1870), and now widely distributed and much grown for its fruit. The Japanese Plum is hardy, in some of its varieties, as far north as Ottawa. It is prized because of its great productiveness, long-keeping qualities and beauty of its fruit, and its relative immunity from black-knot. As a class, the fruit is of lower quality than the domestica Plums. The season of the Japanese Plums begins considerably in advance of the domesticas and holds nearly as late. The greater number of the varieties are clingstones, but there are some freestones among them. A race of hybrids with *P. hortulana* and *P. angustifolia* is now appearing.



1980. Prunus triflora—Japanese Plum.
From specimens in the herbarium at the Royal Gardens, Kew.



1981. Prunus Americana, as it grows wild in New York (× 1-5). See No. 10.

BBB. *American or native Plums: lvs. relatively narrow and smooth and the young growth glabrous (P. subcordata and P. Americana partial exceptions), the fruit comparatively small and in shades of yellow and red, never deep blue-purple.*

C. *Lvs. mostly broad and thick, pubescent or roughish beneath, very sharply serrate or even jagged: fr. thick-skinned.*

9. **subcordàta**, Benth. Small tree or bush, usually only a few feet high: lvs. round-ovate, obtuse, broad or subcordate at base, either sharply or obtusely serrate, thick, soft-pubescent beneath: fls. white fading to rose, less than 1 in. across, in clusters of 4 or less and appearing before the leaves: fr. globular or short-oblong, usually dark red, in the largest wild forms somewhat over 1 in. in diam., the flesh subacid and clinging to the flat smooth stone. High lands and mountains, N. Calif. and Oregon. S.S. 4:154.—The fruit is gathered for domestic uses, and the tree is sometimes planted about settlements. It varies much, and the greater part of the trees do not produce agreeable fruit. In many cases it is only a tree-like bush. The bark is blackish, and is sometimes pubescent on young shoots.

Var. **Kélloggii**, Lemmon. SISSON PLUM. Taller and more slender: bark ash-gray: lvs. not cordate, orbicular or elliptical, nearly glabrous: fr. larger (1 in. or more long), ovate, yellow or red, the flesh soft and palatable. Northern California. Much recommended by Mr. Sisson, near Mt. Shasta, whose name it bears. This Plum is now planted in many places in California. It is superior to *P. subcordata* itself. The tree rarely exceeds 15 ft. in height and 4–6 in. in diameter of trunk.

10. **Americàna**, Marsh. (*P. Texàna*, Scheele). Fig. 1981. Plate XXX. Small, twiggy, spreading, usually thorny tree with gray branches or gray-brown twigs: lvs. obovate, oblong-obovate or sometimes oblong-ovate, acuminate, thickish, the margins mostly sharp-serrate or sometimes almost incised, not glossy, strongly reticulated beneath and pubescent on the veins: fls. large, white, slender-stalked, the calyx-lobes entire and pubescent on the inside, appearing in small clusters in advance of the lvs.: fr. various, but mostly small and hard, the skin tough and glaucous and not shining, yellow and variously overlaid with red; stone turgid. Woods and copses, New York to Colorado and Texas. It sometimes reaches a height of 15–20 ft. S.S. 4:150.—In the East, the fruits are usually austere, and often fit for eating;

but in the West edible-fruited forms are found in abundance. It is the most prolific source of cultivated native Plums for the cold North.

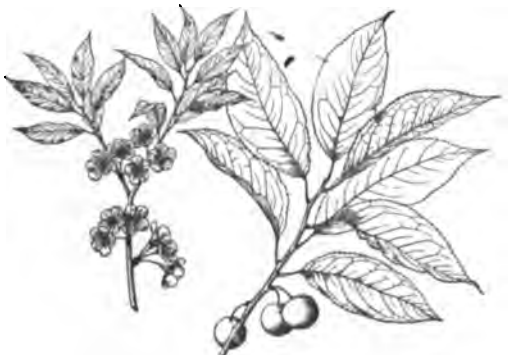
Var. **nigra**, Waugh (*P. nigra*, Aiton). CANADA PLUM. Fig. 1982. Lvs. mostly broader, the petioles bearing 2 glands near the top: fls. larger, on slender dark red pedicels, the calyx-lobes glandular-serrate and glabrous on the inside: fr. mostly somewhat oblong and orange-red, the stone large and much compressed. Newfoundland to Assiniboia, and in New England, and probably descending into the northern Mississippi valley. S.S. 4:149.—A more showy tree than *P. Americana*, blooming earlier, and in its extreme forms appearing to be very distinct, but there are all grades of intermediate forms. It has given rise to some of the best fruit-bearing varieties, such as the Cheney.

Var. **móllis**, Torrey & Gray. Lvs. and shoots soft-pubescent or sometimes almost tomentose. Iowa to Texas.—To this form belong the Wolf and Van Buren Plums. There is also a double-fld. variety.

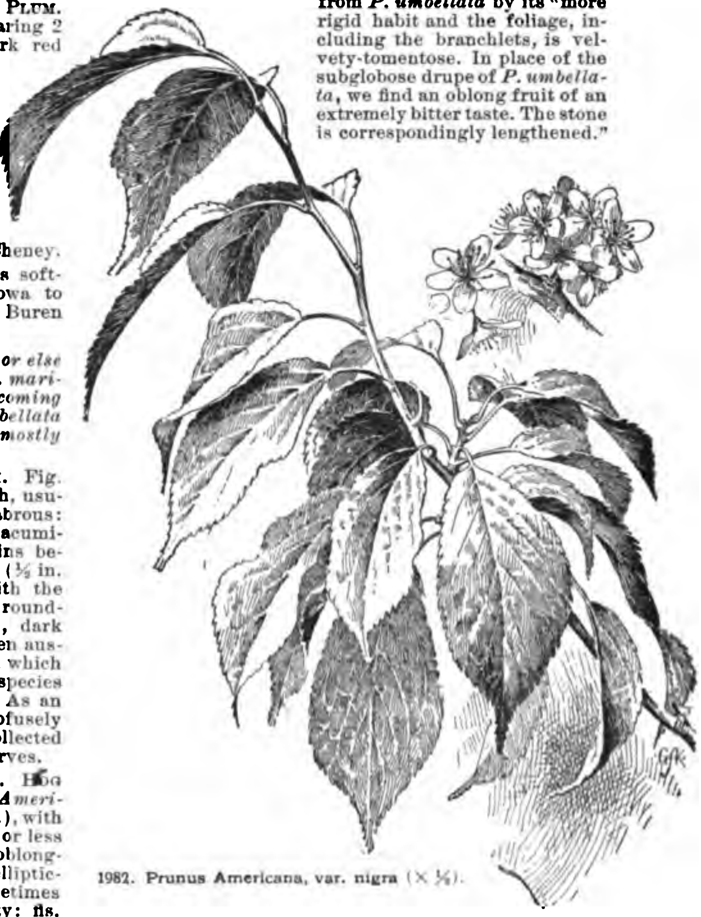
CC. *Lvs. mostly as narrow as lanceolate-ovate, or else small and shortish, thin or thinnish (except P. maritima), finely and usually evenly serrate, becoming glabrous or nearly so (except in forms of P. umbellata and P. maritima) beneath at maturity: fr. mostly thick-skinned.*

11. **Alleghaniénsis**, Porter. ALLEGHENY PLUM. Fig. 1983. Tree 12–15 ft., or oftener a straggling bush, usually not thorny, the young growth reddish and glabrous: lvs. lance-ovate to elliptic-obovate, prominently acuminate, sharply fine-serrate, pubescent on the veins beneath but becoming glabrous with age: fls. small (½ in. across), white, in clusters of 2–5, appearing with the lvs., the calyx minutely pubescent, the petals round-obovate: fr. globular, ⅝ in. or less in diam., dark purple with a heavy bloom, acid in flavor and often austere. Mts. of Pa. S.S. 4:153. G.F. 3:429, from which Fig. 1983 is reduced.—In a very limited way the species has come into botanic gardens and collections. As an ornamental subject it has merit, for it bears profusely of flowers and fruit. The Plums, or "sloes," are collected from the wild for the making of pies and preserves.

12. **umbellàta**, Ell. BLACK SLOE of the South. HOG PLUM (this name is also applied to forms of *P. Americana* and *P. gracilis*). Twiggy small tree (10–20 ft.), with very slender glabrous branchlets: lvs. small (2 in. or less long), light green and rather thin, oblong, oblong-ovate, oblong obovate, or sometimes broadly elliptic-ovate, obtuse or nearly so, closely serrulate, sometimes very closely pubescent beneath even at maturity: fls. small to medium in size, in few-flowered umbels, appearing with or just before the lvs.: fr. small, globular, slender-stalked, from pure yellow to orange-yellow and red-blotched, thinly glaucous, the flesh usually sour and bitter and free from the stone. Near the coast from S. Car. to Tex. S.S. 4:155.—Not introduced as a fruit-plant, but sometimes planted for the profusion of its white flowers. The fruit is not unlike a Cherry in shape. The foliage suggests *P. cerasifera*. A species recently described, **P. injucúnda**, Small, from Stone Mountain, Ga., and not in the trade, is distinguished from *P. umbellata* by its "more rigid habit and the foliage, including the branchlets, is velvety-tomentose. In place of the subglobose drupe of *P. umbellata*, we find an oblong fruit of an extremely bitter taste. The stone is correspondingly lengthened."



1983. Prunus Alleghaniensis (X ⅓).



1982. Prunus Americana, var. nigra (X ⅓).

13. **maritima**, Wangh. BEACH PLUM. Fig. 1984. Decumbent straggling more or less thorny bush with rough and warty branches and slightly pubescent young growth: lvs. oval or obovate-oval, short-acute or nearly obtuse, closely serrate, dull green, often somewhat pubescent beneath: fls. small, slender-stalked, in few-flowered umbels preceding the lvs.: fr. about ½ in. in diam., depressed-globular (somewhat flattened at the ends), with a slight cavity about the stem, mostly deep dull purple when ripe and covered with a heavy bloom, the flesh brittle and mostly sweet and juicy and free from the small, turgid, cherry-like stone (which is pointed at both ends), the skin thick, tough and more or less acrid. Sands of the seashore, New Brunswick to Virginia; also at the head of Lake Michigan. Gng. 4:257 (bush in bloom).—The main stems are decumbent, and strong shoots stand upright to a height of 2–6 ft., or sometimes even 10–12 ft. *P. maritima* is a handsome plant in cultivation because of the great profusion of its early spring bloom, and the fruits, when produced, are also ornamental. As a fruit plant it is known in the variety Bassett American, which, however, has never become popular because of its small size. The species is very variable, and no doubt several botanical varieties could be distinguished. Yellow-fruited forms are known.

Species related to *P. maritima*, but not in the trade, are **P. Gràvesii**, Small, Connecticut, with orbicular very obtuse and often apiculate lvs. and stone pointed only at base. **P. grácilis**, Engelm. & Gray, Tenn. to Kans. and Tex., a shrub not more than 4 or 5 ft. tall, soft-pubescent, with small, oval-lanceolate lvs. and very small nearly globose fr.; **P. glandulòsa,** Torr. & Gray, Tex., a low bush with very crooked and pubescent branches, very small, oval-obtuse lvs., and a small velvety fruit.

OOO. *Lvs. mostly narrow and peach-like, firm and more or less shining, glabrous, the young growths not pubescent: fr. thin-skinned.*

14. **angustifòlia,** Marsh. (*P. Chicàsa,* Michaux ?). CHICKASAW PLUM. MOUNTAIN CHERRY. Fig. 1985. Plate XXX. Small, bushy-topped twiggy tree, with slender zigzag reddish branches: lvs. lanceolate or oblong-lanceolate and conduplicate (trough-like), shining, finely and closely serrate: fr. small and early, cherry-like, slender-stemmed, red or yellow and yellow-dotted, shining, thinly glaucous, the flesh soft and juicy and clinging to the small, rough stone. Del., south and west, being abundant in the sandy thickets. S.S. 4:152.—This species has given rise to several worthy pomological varieties, as Newman and Lone Star. It is not hardy in New York. It sometimes reaches a height of 20–25 ft., but it is often a small, bushy tree. It is supposed that Michaux had this plant in mind when he made the name *P. Chicasa.* The specimens in his herbarium (in Paris) are *P. hortulana,* however; but they are marked with an interrogation point, as if he were not sure of them, and they may not represent his idea of the species.

Var. **Wàtsoni,** Waugh (*P. Wàtsoni,* Sarg.). SAND PLUM. Fig. 1986. Bush, 3–6 ft. high, with more zigzag twigs than in *P. angustifolia,* more spiny, the lvs. and fls. smaller, the fr. with thicker skin. Dry regions of Nebraska, Kansas and Oklahoma, and planted by the settlers, who prize it for its fruit. G.F. 7:135.

1984. Prunus maritima. (×¼.) See No. 13.

15. **hortulàna,** Bailey. WILD GOOSE PLUM. Fig. 1987. Mostly taller tree than *P. angustifolia,* with straighter twigs, not thorny: lvs. plane or flat, closely and obtusely-glandular serrate: fr. globular, glossy and thinly glaucous, lemon-yellow to red, juicy, the thin flesh clinging to the small rough stone. S. S. 4:151.—A group of hybrids of *P. Americana* and *P. angustifolia,* but occurring in the wild from Maryland and Virginia to Texas. In orchards it is represented by many varieties, of which the Wild Goose is the best known. One branch of the species-group, var. **Mineri,** Bailey, is near to *P. Americana,* and represents the northward extension of the group: it is known by its thicker and duller lvs. which are very veiny below and coarsely toothed and somewhat obovate in outline, and by a late firm fruit. To this form belong the Miner, Langsdon, Clinton, Forest Rose. Another branch of the hortulana group, var. **Wàylandi** (Fig. 1988), is characterized by strong growth, straight dark-colored twigs, broad, heavy, coarsely toothed shining lvs. with 2–6 glands on the petioles, late blossoming, and thin-skinned fr. of good flavor. This form is common in the middle South and Texas. It is represented in cultivation by many excellent varieties, as Wayland, Golden Beauty, Moreman, Reed, Garfield, Cumberland and others. This is apparently the "Prunus spec. Texas" described and figured by Dippel in Laubholzkunde, 3, p. 626. Waugh has suggested that *P. rivularis,* Scheele, is this Wayland type of Plums. Two sheets of Lindheimer's specimens, duplicates of those on which Scheele founded the species, are in the Gray Herbarium. They represent a small, crabbed-growing bush with small conduplicate lvs. that are hairy beneath, and very small slender-stalked fls. just preceding the lvs. It is very doubtful if they can be held to represent the Wayland Plums. They are rather to be compared with *P. orthosepala,* Koehne.

1985. Leaf of Prunus augustifolia. Natural size.

Prunus orthosèpala, Koehne, from southern Texas (G. F. 7, p. 184, Fig. 34) is, according to Sargent, "rather closely related to *Prunus hortulana,* from which it can be distinguished by the smaller number of glands on the petioles, by the eglandular calyx-lobes, the dark-colored fruit and smoother stone." It is a twiggy shrub growing 4 or 5 ft. high. Lvs. oblong-ovate, acuminate, coarsely serrate, shining above, pilose beneath: fls. white or tinged pink, appearing with the opening of the leaf-buds: fr. globose, 1 in. in diam., dark blue or nearly black, glaucous, the flesh yellow and of good quality. This plant must be further studied before its botanical position can be determined. Possibly it is a geographical form of the Sand Plum or the Hortulana group, although the hairiness of the lvs. beneath distinguish it. Not in the trade.

SUBGENUS II. CERASUS. Cherries.

Fruit globular or oblong, not sulcate, glabrous and usually not glaucous, the stone turgid (usually nearly globular), and rarely conspicuously longer than broad and smooth: fls. in umbel-like fascicles (mostly solitary in *P. tomentosa*), mostly with or immediately preceding the leaves.

A. *Plant dwarf, usually only a bush, with no central trunk.*

16. **pùmila,** Linn. SAND CHERRY. DWARF CHERRY. Fig. 1989. Decumbent at the base when old, but the young growth strictly erect and often reaching 5–8 ft. in height, the slender, twiggy growth reddish and glabrous: lvs. narrowly oblanceolate, acuminate, short-pointed or nearly obtuse, the margins above very closely serrate, dull green above and whitish green beneath: fls. small, in 2–5-fld. umbels, the pedicels slender: fr. nearly globular, purple-black, on

1986. Prunus angustifolia, var. Watsoni.—The Sand Plum (×¾).

1987.
Wild Goose—Prunus hortulana.
(× ½.)
See No. 15.

slender stems. On sandy and rocky inland shores from Maine to the District of Columbia and Winnipeg.—The fruit is small and usually scarcely edible, the flesh being astringent. The species is common on dunes of the Great Lakes. It is in cult. as an ornamental plant, for which it is worthy, although it is much attacked by the twig blight (caused by the fungus Monilia).

Var. **cuneàta** (*P. cuneàta*, Raf.). Fig. 1990. More erect from the base: lvs. thin, oval, short-obovate or spatulate, strongly toothed: fls. larger. Bogs and cool woods in the northern states. Not in the trade, so far as known.

Var. **Bésseyi**, Waugh (*P. Bésseyi*, Bailey). WESTERN SAND CHERRY. Figs. 1991, 1992. Known from *P. pumila* by its more prostrate habit, lvs. spreading (more erect in *P. pumila*), broad and thick, usually elliptic, elliptic-oval, or elliptic-lanceolate: stipules on strong shoots, large and green, serrate: fr. nearly or quite twice larger, on short stalks, usually sweet or at least edible.—This is the Sand Cherry of the Plains and the West, ranging from Kansas to Manitoba and west to Utah and Colorado. The original of the Improved Rocky Mountain Cherry, a plant grown for its large sweet fruit. In its extreme form this plant looks to be distinct, but it seems to intergrade imperceptibly into *P. pumila*.

17. **Utahénsis**, Dieck. UTAH HYBRID CHERRY. Apparently a hybrid of *P. Watsoni* and *P. pumila*, var. *Besseyi*. A small, tree-like bush: lvs. lance-elliptic to oblong-ovate, short-pointed or nearly blunt, finely serrate, slightly conduplicate, glossy above and much reticulated beneath: fr. cherry-like, somewhat larger than that of *Besseyi* (about ⅝ or ¾ in. in diam.), of deep mahogany color, with a thin plum-like bloom, a thin flesh and a relatively large cherry-like stone.—Appears to have been raised about 40 years ago from seed of *P. pumila*, var. *Besseyi* (*P. Watsoni* grew near) by J. E. Johnson, in Nebraska. Mr. Johnson subsequently moved to Utah, whence the fruit was distributed. It has little value as a fruit-plant, but it is an attractive ornamental subject, both in flower and fruit.

18. **fruticòsa**, Pall. (*P. Chamæcérasus*, Jacq. *P. pùmila*, Hort. *Cérasus Sibírica*, Hort.). DWARF CHERRY, or GROUND CHERRY of Europe. Spreading bush, 2–4 ft. high, with slender glabrous branchlets: lvs. varying from obovate to oblanceolate and lanceolate, the apex acuminate or sometimes almost obtuse, closely serrulate, thickish, shining above, the petiole short: fls. white, in nearly or quite sessile umbels: fr. small, globular, purple-red, very sour. Highlands and mts. of Germany, Austria-Hungary and southern Russia.

Var. **péndula**, Hort. (*Prùnus*, and *Cérasus, Japónica péndula*, Hort.), is a most ornamental form with drooping branches, excellent for top-working on standard stocks (Fig. 1993). This is sometimes confounded with *P. semperflorens*, but is distinguished at once by its foliage, its early blooming, its fls. in clusters, and its dwarf habit. This is the form of *P. fruticosa* that is chiefly known in this country. A similar pendulous form, but with larger and more crenate-serrate lvs., is known as *P. reflexa*, Hort.; perhaps a hybrid of *P. fruticosa* and *P. semperflorens*. Var. **variegàta**, Hort., has lvs. marked with yellowish white.

AA. *Plant a tree or tree-like.*

B. *Trees grown only for ornament or for stocks (not pomological species).*

C. *Flower-clusters simple, sessile or very nearly so.*

D. *Lvs. tomentose beneath.*

19. **tomentòsa**, Thunb. Small tree, or sometimes a tree-like bush, the young growths pubescent-tomentose: branches close-jointed, causing the lvs. and fls. to be numerous: lvs. broad-oval to short-obovate, short-stalked, abruptly contracted into a short point, the margins incisely and sometimes unequally serrate, dull and rugose above, densely pubescent-tomentose beneath: fls. small, sessile, usually 1 or 2 at a joint, pinkish, appearing just before the lvs.: fr. light red, globular, the size of a very small cherry, sessile or very short-stalked, sparsely hairy, said to be eaten in Japan but too small to be of much importance for food. N. China and Manchuria. A.G. 12:77. G.F. 5:581.—A very worthy hardy small tree, making a very dense top, and quite unlike most other Cherries in appearance.

1988. Prunus hortulana, var. Waylandi (× ¼). No. 15.

DD. *Lvs. glabrous or nearly so.*

E. *Shape of lvs. roundish,—nearly as broad as long: fl.-clusters on the ends of the branchlets.*

20. **Mahàleb**, Linn. MAHALEB CHERRY. ST. LUCIE CHERRY. Small, slender tree with hard glabrous branchlets: lvs. light green, round-ovate to orbicular, abruptly very short-pointed, often subcordate at base, the mar-

1989. Prunus pumila—Sand Cherry (× ½). No. 16.

gins closely callous-serrate: fls. small, fragrant, white, in small terminal umbels in May and June (in New York), appearing when the tree is in nearly full leaf: fr. very small, dark red, not edible. Middle and southern Europe and the Caucasus.—Extensively imported for cherry-tree stocks, and sometimes run wild.

EE. *Shape of lvs. distinctly longer than broad: fl.-clusters mostly lateral.*

F. *Native Bird Cherries, bearing very small white fls. and a profusion of very small red fruits.*

21. **Pennsylvánica,** Linn. COMMON WILD BIRD or PIN CHERRY. Fig. 1994. Shallow-rooted tree with slender red-barked branches, 25–40 ft. high and sometimes 1½ ft. in diam. of trunk: lvs. oblong-lanceolate-acuminate, light green and rather thin, closely sharp-serrate: fls. small, white, slender-stalked, appearing with the lvs., in 2's or 3's: fr. the size of a pea, light cherry-red, the flesh thin and sour and somewhat puckery: stone oblong. Sandy and rocky lands, Newfoundland to British Columbia, and south in the mountains to Colorado and N. Carolina. S.S. 4:156.—Where the tree grows naturally, it often sprouts inveterately and becomes a nuisance. When bruised, the wood has a strong peach-like odor. It is an interesting ornamental tree, however. In poor soils, it is often little more than a bush. On large trunks the bark tends to peel in transverse strips.

1990. Prunus pumila, var. cuneata. (× ½.) No. 16.

22. **emarginàta,** Walp. Sometimes 40 ft. high: lvs. oblong-ovate or oblanceolate, mostly obtuse, closely serrate, often somewhat pubescent beneath: fls. tinged green, appearing with the lvs. in 6–12 ft. glabrous or pubescent corymbs: fr. larger than that of *P. Pennsylvanica*, almost black when ripe, the flesh thin and bitter: stone ovoid. High lands from Montana to British Columbia and California. S.S. 4:157.—Sometimes offered as an ornamental tree.

FF. *Exotic Cherries, bearing showy white or pink fls. in rather profuse clusters, the fruits larger (when produced).*

23. **semperflòrens,** Ehrh. EVERBLOOMING CHERRY. ALL-SAINTS' CHERRY. Fig. 1995. Small tree or a bush, usually top-worked on other stock, with a straggling or drooping habit, the slender twigs glabrous: lvs. oval to oblong-obovate, short-pointed (or acuminate on the strong shoots), irregularly dentate, rather hard and firm in texture: fls. white, on long, axillary and terminal peduncles from May till September: fr. like a small pie Cherry, but mostly longer-stalked and smaller, dark red.—Probably a cultivated offshoot of the pie or Morello Cherry, *P. Cerasus*. By some its parent species is thought to be distinct from *P. Cerasus*, and is separated as *P. acida*, Koch. See No. 28. R.H. 1877:50. Gn. 50, p. 313. Its habit of blooming all summer makes it a desirable ornamental subject. The leaves resemble those of *P. Cerasus*, except that they are smaller. Known in France as *Cerisier de la Touissaint* ("All Saints' Cherry"). There is a form with yellow-variegated lvs.

24. **péndula,** Maxim. (*P. subhirtélla*, Miq., in part. *Cérasus péndula*, Sieb. *C. Itosakùra*, Sieb. *C. Japónica* and var. *ròsea*, Hort.). ROSE-BUD CHERRY. JAPANESE WEEPING ROSE-FLOWERED CHERRY. Fig. 1996. Small tree, with drooping crooked branches: lvs. ovate to oblong-ovate, acuminate, very sharp-serrate, usually pubescent beneath (at least on the strong shoots): fls. ¾–1 in. across, on long minutely pubescent stalks, in small clusters from lateral buds before the lvs. appear, rose-pink, the petals notched at the tip, the calyx-tube funnelform and red: fr. very small, globular, black-red, somewhat astringent. Japan. R.H. 1876, p. 328. Gn. 50:1095. G.F. 1:198; 2:487 (old tree). Gng. 2:269. M.D.G. 1890:320–1. Var. **ascéndens,** Makino, is an upright form. B.M. 7508. M.D.G. 1900:319, 320.—One of the handsomest of early-flowering trees, producing its chaste pink flowers in profusion. Usually top-worked on *P. Avium*. Hardy in central New York. Miquel's name, *subhirtella*, is older than Maximowicz's *pendula*, but Miquel confused two species, and it seems to be desirable to drop the name.

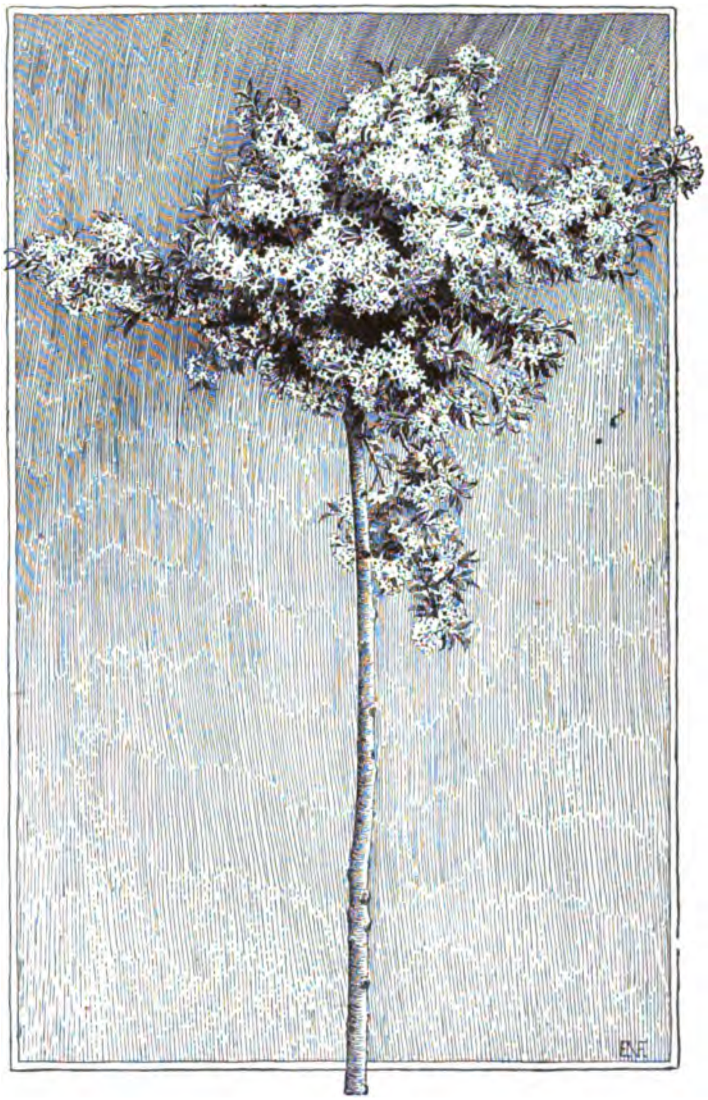
OO. *Flower-clusters from lateral winter-buds, peduncled and bearing 2–5 fls., with prominent serrate bracts at the forks.*

25. **Pseùdo-Cérasus,** Lindl. (*P. Púddum*, Miq., not Roxbg.). JAPANESE FLOWERING CHERRY. Figs. 1997, 1998. Strong-growing tree, like a Sweet Cherry: lvs. ovate to oblong-ovate, long-acuminate, glabrous or nearly so, the margin deeply sharp-serrate or toothed, the stipules usually large and serrate on the young growths: fls. large, pink or blush, appearing with the first lvs. or slightly in advance of them, on glabrous or hairy pedicels, the peduncle branching: fr. spherical, small, very dark red, subacid, somewhat astringent. China, Japan, Manchuria. G.C. III. 7:609; 19:467, 517. Gn. 50, p. 318; 56:1244 and pp. 5, 8. J.H. III. 34:139. G.F. 10:463. A.G. 12:402–3.—The botanical status of the trees cultivated under this name is not well understood. It is by no means certain that all of these plants belong to *P. Pseudo-Cerasus* as described by Lindley. Our knowledge of the group is yet too imperfect to warrant a thorough revision.

Var. **horténsis,** Maxim. (*Cérasus serratifòlia*, Lindl. *C. serrulàta*, Hort. *C. Lannesiàna*, Carr. *P. donàrium*, Sieb.). This is the famous ornamental Cherry of Japan, where it is cultivated in many forms, some of them being full double. It differs from the type in having somewhat narrower lvs., with smaller serratures and large fls. It is now frequently planted in this country, particularly the double-fld. forms, but it is not quite as hardy as the

1991. Western Sand Cherry—Prunus pumila, var. Besseyi (× ½). No. 16.

1992. Prunus pumila, var. Besseyi (× ½).



1993. Weeping dwarf cherry of Europe, grafted on Morello stock.

One of the best of the small ornamental species, and known under several names in nurseries.—*Prunus fruticosa*, var. *pendula*. See No. 18.

Sweet Cherry (*Prunus Avium*). Fls. white or blush, showy. R.H. 1873:351 (as *Cerasus Lannesiana*); 1875: 390 (erroneously as *C. Juliana* var.); 1877: 390. F.S. 21:2238–9 (as *Cerasus Caproniana* var.). Gn. 52, p. 408.

Var. **Sièboldi**, Maxim. (*Cérasus Sieboldi*, Carr. *C. Japónica*, Hort. of some. *C. Wàtereri*, Hort. *P. paniculàta*, Hort., not Thunb.). Differs in having young lvs. pubescent, and the shoots pubescent even until fall, the lvs. relatively short and broad. Not uncommon in cult. B.R. 10:800. R.H. 1866:371.

26. **Púddum**, Roxbg. A Himalayan representative of *P. Pseudo-Cerasus*, described by Hooker as a large tree of brilliant appearance in flower, glabrous except the puberulous young shoots, the rose-red or white flowers solitary, fascicled or umbelled, the calyx-tube narrowly campanulate and the petals obovate or linear-oblong: lvs. ovate-lanceolate or oblong-lanceolate, caudate-acuminate, sharply serrate, glabrous, 3–5-in. long, the petiole with 2–4 glands: fr. oblong or ellipsoid, obtuse at both ends, with scanty yellow or reddish acid flesh: stone bony and furrowed. Temperate Himalaya, 3,000–8,000 ft.—The name is catalogued in Southern Calif., with the statement that the tree "blossoms in November and ripens its fruit in April." Hooker (Fl. Brit. India) places it with species having "flowers appearing before the leaves."

BB. *Trees grown for fruit (pomological species), but known also in ornamental forms.*

27. **Avium**, Linn. SWEET CHERRY. MAZZARD. Figs. 426, 428, 431, 1999. Tall, robust tree with red-brown bark, the young trees with a strong central leader and pyramidal growth, the old seedling trees sometimes becoming 2 ft. and more in diameter (see Fig. 428, Vol. I): lvs. generally oblong-ovate and gradually taper-pointed, dull and soft in color and texture, hanging as if limp on the young growths: fls. in dense clusters on lateral spurs and appearing with the hairy strongly conduplicate young lvs., the scales of the fl.-buds large and persistent for a time: fr. globular, depressed-globular or heart-like, mostly sweet, yellow or red. Europe and Western Asia.—The parent species of the many Sweet Cherries (and also of the May Duke class), and now run wild in many parts of the East. The run-wild and common seedling forms, with small fruits, are known under the general name of Mazzard Cherries. Mazzard stocks, mostly imported, are used as stocks for Cherries, although Mabaleb is more popular with propagators because (like the Myrobalan Plum) it is easier and cheaper to grow, runs more uniform and is capable of being budded through a long season. There are many ornamental forms of the *P. Avium*, as: var. **pyramidàlis**, Hort., tree making a pyramidal crown; var. **péndula**, Hort., with drooping branches; var. **variegàta**, Hort., with yellow and dull white markings on the foliage; also various cut-leaved and double-fld. forms. To this species are to be referred such garden names as *P. angustifolia, asplenifolia, heterophylla, salicifolia*.

Var. **Juliàna**, Hort. (*Cérasus Juliàna*, DC.). HEART or GEAN CHERRIES. Fruit heart-shaped, with soft flesh, as in the varieties Governor Wood, Black Tartarian, Black Eagle. These are the *Guigniers* and *Heaumiers* of the French. A weeping form is known as *P. Juliana*, var. *pendula*.

Var. **regàlis**, Bailey (*C. regàlis*, Poit. & Turp.). DUKE CHERRIES. Differ from the Heart Cherries in having an acid flesh (and for that reason often erroneously referred to *P. Cerasus*). May Duke is the leading representative.

Var. **Duracina**, Hort. (*C. Duracìna*, DC. *C. Bigarélla*, Roem.). BIGARREAU CHERRIES. Distinguished by the firm breaking flesh of the fruit, which is mostly of light color. Here belong the Windsor, Yellow Spanish, Napoleon.

Var. **Decumàna**, Dipp. (*C. Decumàna*, Delaun. *P. macrophýlla*, Poir. *P. nicotianæfòlia*, Thomps.). Lvs. very large (sometimes nearly 1 ft. long), somewhat heart-shaped. Grown for ornament.

28. **Cérasus**, Linn. (*Cérasus vulgàris*, Mill. *C. Caproniàna*, DC. *P. àcida*, Gærtn., not K. Koch. *P. austèra*, Ehrh.) SOUR, PIE, or MORELLO CHERRY. Figs. 427, 429, 430. Rather low, round-headed tree with gray bark and

no central leader (compare Figs. 426 and 427, Vol. 1): lvs. ovate-obovate or short-ovate, abruptly short-pointed, stiff and parchment-like and more or less glossy above, light or gray-green: fls. in small clusters from lateral buds mostly in advance of the lvs., the scales of the fl.-buds small: fr. roundish or depressed-globular, red, soft-fleshed, acid: stone globular. Native to Asia Minor and perhaps to southeastern Europe.—*P. Cerasus* is the common Pie Cherry of old yards. It escapes into fence-rows and other waste places, forming dense thickets, as the Plum does. It sprouts from the root. The various Morellos belong here; also the Montmorency, Louis Phillippe, and others. There are at least two well-marked groups of these pomological Cherries—those with uncolored juice (Amarelles, the *Prunus acida* of some), and those with colored juice (Morellos or Griottes). To the former group belong the Montmorency, Early Richmond, and several early varieties. The *Prunus acida* of Karl Koch (*Cerasus acida*, Dumort.) is a bush-like plant with slender pendulous branches and smaller lvs., the petioles usually gland-bearing (less so in *P. Cerasus*), the fruit dark red and sour, the stone ovoid; of this plant *P. semperflorens* (No. 23) is a form. It is generally considered, however, that this *P. acida*, including *P. semperflorens*, is a derivative from *P. Cerasus*. Even if it is a distinct species, the name *P. acida* of Koch cannot stand, for it is antedated by the *P. acida* of Ehrhart; *P. semperflorens*, Ehrh., therefore, must hold as the species-name. Ornamental forms of *P. Cerasus* are: Var. **ranunculiflòra,** Hort. (*C. Rhéxii*, Hort.). Fls. full double, white, F. S. 17:1805. Var. **persicæflòra,** Hort. Fls. full, double, light rose or pink. Var. **variegàta,** Hort. Lvs. variegated with yellow and dull white.

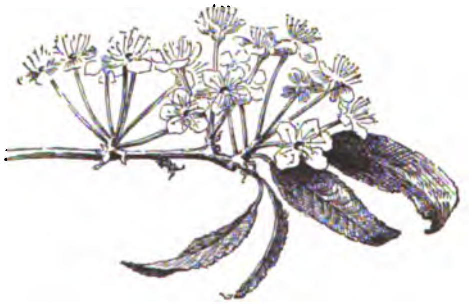
SUBGENUS III. PADUS (including *Laurocerasus*).

Fruit small and globular, rarely used for eating: fls. white, small, in distinct racemes, not preceding the lvs., or arising from the axils of persistent lvs. of the year before.

A. *Padus proper: lvs. deciduous: fls. on leafy shoots of the season.*

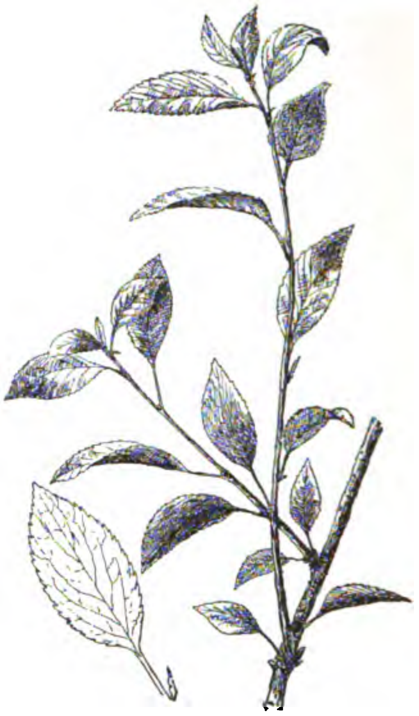
B. *Calyx-lobes persistent at the base of the fr.: fls. appearing relatively late in the season: large trees.*

29. **serótina,** Ehrh. WILD BLACK CHERRY. Strong, straight tree, reaching 100 ft., with very dark brown bitter-aromatic bark: lvs. oblong, lance-oblong or oblong-ovate, tapering to a point, thickish and firm, shining above, with many small incurved callous teeth: fls. in long, loose racemes, appearing when the lvs. are nearly full grown: fr. size of a pea, purple-black, bitterish, ripening in late summer and September. Generally distributed from Nova Scotia to Dakota, south to Fla. and Texas. S.S. 4:159.—A valuable timber tree, furnishing lumber for cabinet work and house finishings; also a fine lawn tree. It is much used in forestry plantings. Var. **péndula,** Hort., has drooping branches. Var. **variegàta,** Hort., has yellow-marked lvs. Var. **cartilagínea,** Hort. (var. *Carthagèna*, Hort., by error. *P. cartilagínea*, Lehm.), is a handsome form with very long, shining lvs. Var. **asplenifòlia,** Hort., has narrow, deeply toothed lvs.



1994. Prunus Pennsylvanica (× ½). No. 21.

Var. **salicifòlia,** Kœhne (*P. salicifòlia*, HBK. *P. Cápuli*, Cav. *Cérasus Cápollin*, DC.). CAPULIN. Lvs. narrower (usually narrowly lanceolate), smooth and shining, usually more leathery. Western Tex., Ariz., New Mex., Mex. and south. R.H. 1888, p. 137; 1893:496.



1995. Prunus semperflorens (× ½). No. 23.

BB. *Calyx-lobes not persistent on the fr.: fls. early: small trees.*

30. **Virginiàna,** Linn. CHOKE CHERRY. Fig. 2000. Bush or sometimes a small tree 30 ft. tall, with rough speckled bark and a strong odor when bruised: lvs. thin, oval-oblong or obovate, abruptly pointed, very sharply serrate, with spreading or at least not incurved teeth: fls. in short, dense racemes in spring with the lvs.: fr. size of pea, in summer, red or amber-colored (the latter var. *leucocárpa*, Wats.), puckery: stone smooth. Generally distributed over northern North America to the Arctic circle and occurring in the mountains of Mex. S.S. 4:158.—Now and then a large-fruited variety is found, fit for eating. Sometimes planted for ornament. There is a weeping form, var. **péndula,** Hort.; a dwarf form, var. **nàna,** Hort.; a narrow-lvd. form, var. **salicifòlia,** Hort. The fruit is usually unfit for eating, but forms are known with edible fruit.

Var. **demíssa,** Torr. (*P. demíssa*, Walp.). Lvs. more rounded or even subcordate, somewhat pubescent, thicker: fr. dark red or purple-black, large and edible. Nebraska and Dakota, west and south.—Considered by Bessey (Nebr. Hort. 1895, p. 164) to be worthy of improvement as a fruit plant. He thinks it more nearly related to *P. serotina* than to *P. Virginiana*.

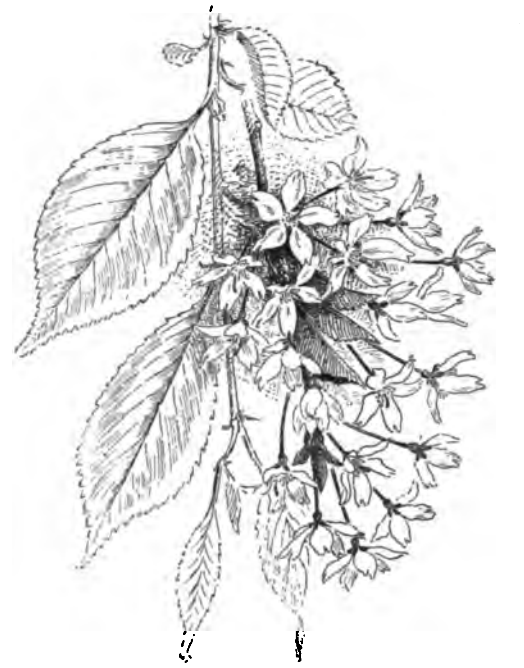
31. **Pàdus,** Linn. EUROPEAN BIRD CHERRY. Very like *P. Virginiana*, but has larger fls. on longer pedicels, in longer and looser often drooping somewhat leafy racemes: fls. appearing a week later: stone rough. Europe and Asia. Gn. 53, p. 92.—Common in cult. in many forms: var. **péndula,** Hort., drooping; var. **variegàta,** Hort., in several forms, as *aurea*, *aucubæfolia*, *marmorata*, *Alberti*. Var. **commutàta,** Dipp. (*P. Grayàna*, Hort., not Maxim.) is noteworthy because it is one of the earliest of all trees to leaf out in spring. G.F.

1:295. There is a double-fld. form. Variable in its foliage. Makes a shapely tree 10–20 ft. tall.

AA. *Laurocerasus: lvs. persistent (evergreen): fls. in spring in the axils of the lvs. of the previous year.—Laurels.*

B. *Racemes longer than the lvs.*

32. **Lusitánica,** Linn. PORTUGAL LAUREL. Tree, 20 ft. tall. but usually grown as a tub plant and comparable to *Laurus nobilis:* lvs. thick and leathery, ovate-lanceolate to long-lanceolate, sharp-serrate: fls. white, in racemes that exceed the lvs., appearing in late spring or early summer: fr. round-oval, nearly black, small. Spain and Portugal and Canaries.—It is a small tree in its native places, but becomes a bush farther north. It is sometimes planted in the open ground in our southern states, but in northern parts it is a tub plant. There is a form with variegated lvs., another (var. **angustifòlia.** Hort.) with narrow lvs., and another (var. **myrtifòlia,** Hort.) with small lvs. and compact habit.



1996. Prunus pendula, the rose-bud cherry (× ½). No. 24.

BB. *Racemes not longer than the lvs.*

C. *Calyx-lobes toothed or undulate.*

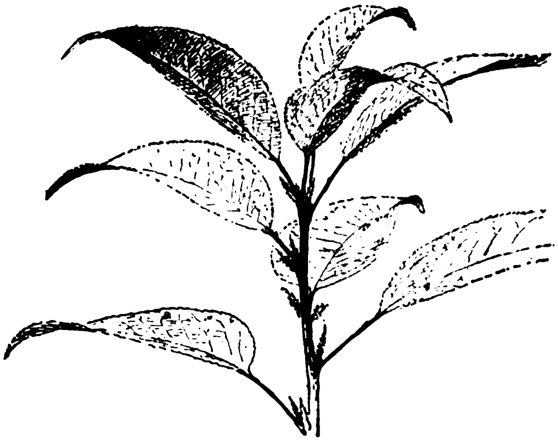
33. **Laurocérasus,** Linn. CHERRY LAUREL. ENGLISH LAUREL. Bush or small tree (reaching 10 ft.) with handsome evergreen foliage: lvs. coriaceous and glossy, short-stalked, oval, lanceolate, oblong-elliptic or oblanceolate, narrowed into a short point, remotely serrulate, with 2–4 glands at the base of the blade: fls. small, white, in axillary or terminal short racemes in spring, the calyx-lobes 3-toothed: fr. ovoid-acute, small, blackish. Southeastern Europe to N. Persia. Gn. 50, p. 313.—One of the most popular broad-leaved evergreen plants in Europe, and somewhat planted in the southern states. It is also grown in tubs and used for house decoration. Some of the forms will stand as far north as Washington, and var. *Schipkaensis* is hardy in central New York. When grown in the open, the Cherry Laurel should be allowed to ripen its wood thoroughly before winter sets in. Protection from severe winds is always desirable. The plant may be propagated by means of long cuttings of ripe wood; also by layers. Named varieties are worked on common stocks. The Cherry Laurel is very variable. Some of the horticultural forms are as follows: Var. **angustifòlia,** lvs. very long and narrow, and plant hardy as far north as Washington; var. **Bertini,** with very broad leaves; var. **camelliæfòlia,** with recurved leaves; var. **Caucásica,** and var. **Cólchica,** with slender twigs and dark foliage which is gray-green beneath, also hardy; var. **Japónica,** a narrow-leaved form, like var. *angustifolia;* var. **latifòlia,** with broad lvs., hardy at Washington; var. **microphýlla,** with small, narrow lvs., only 4–5 in. long; var. **rotundifòlia,** with short-oblong blunt lvs. Gn. 28, p. 405. Var. **Schipkaénsis,** with small, nearly or completely entire lvs. dark green above and very light green beneath, hardy in New York; var. **variegàta,** lvs. marbled or blotched with dull white.

34. **Caroliniàna,** Ait. WILD ORANGE. MOCK ORANGE of the South. Tree, 20–40 ft.: lvs. oblong-lanceolate-acuminate, usually entire but sometimes remotely spinose-serrulate, thick, dark green and shining above, the margins usually somewhat revolute: fls. cream-colored, in short rather close racemes, the calyx-lobes with undulate margins: fr. ½ in. long, oblong-pointed, black and shining. S. Car. to Fla. and Tex. S.S. 4:160.—A handsome evergreen, prized for planting in the South. Blooms from Feb. to April.

CC. *Calyx-lobes entire.*

35. **ilicifòlia,** Walp. ISLAY. SPANISH WILD CHERRY. MOUNTAIN EVERGREEN CHERRY. Fig. 2001. Evergreen bush or small tree, rarely becoming 30 ft. tall, with a dense crown: lvs. holly-like, ovate to ovate-lanceolate, obtuse, acute or sometimes even acuminate, mostly broad and sometimes rounded at the base, the margins coarsely spiny-toothed, the blade thick and shining: fls. white, in slender racemes less than 2 in. long in spring, about ⅓ in. across: fr. rather large (sometimes ⅔ in. long), nearly globose, purple or nearly black; stone ovate. San Francisco to Lower Calif. Gn. 3, p. 131. S.S. 4:162. G.F. 5:475 (tree).—A most worthy garden plant.

Var. **integrifòlia,** Sudw. (*P. occidentàlis,* Hort., not Swartz). CATALINA CHERRY. Lvs. longer and more acuminate, usually entire: fr. larger. Islands off the coast of southern California and rarely on the mainland. S.S. 4:163.—Considered to be more desirable as a garden plant than the type. It grows rapidly under cultivation, making a compact, very dark green crown. Useful also in pots and tubs. *P. occidentalis,* Swartz, a different plant, grows from Cuba to Trinidad. It is not in the trade, although it is mentioned in a recent list of "seeds and plants imported for distribution in coöperation with the agricultural experiment stations" by the U. S. Dept. of Agric. Grisebach describes it as a high tree: lvs. oblong or ovate-oblong, rounded at the base, bluntish, with 2 glandular spots at the base beneath: racemes lateral, puberulous or glabrous: fr. ovoid, slightly apiculate, nearly 1 in. long, purple. The fruit is said to be "of very fine flavor."



1997. Prunus Pseudo-Cerasus (× ⅓). No. 25.

1998. Japanese Flowering Cherry—Prunus Pseudo-Cerasus (× ⅓). No. 25.

SUBGENUS IV. CHAMÆAMYGDALUS (including *Microcerasus*). Dwarf Almond.

Fruit small, either firm or juicy, glabrous or pubescent: plant dwarf, with sessile flowers solitary or in pairs preceding the lvs., the stamens 20 or more, the calyx-tube tubular: lvs. conduplicate.

36. incàna, Decne. (*Cérasus incàna*, Spach. *Amýgdalus incàna*, Pall. *A. nàna*, var. *incàna*, Loud.). Shrub of medium size: lvs. small, the petiole short and soft-hairy and glandless or bearing glands at the very top, the blade obovate-oblong, elliptic or lance-elliptic, short-pointed or obtuse, finely sharp-toothed, white-tomentose beneath: fls. mostly in 2's, appearing with the lvs. or just in advance of them, light rose-color, about ½ in. across, the petals emarginate: fr. bright red, the size of a pea, smooth, juicy. Southeastern Eu. and western Asia. R.H. 1853:281. B.R. 25:58. Gt. 44, p. 243 (leaf).

37. nàna, Stokes (*Amýgdalus nàna*, Linn.). RUSSIAN ALMOND. Fig. 2002. Bush, 3 to 5 ft. high: flowers solitary, appearing a little in advance of the leaves, sessile, pink and showy: lvs. narrowly elliptic or elliptic lanceolate, 2 or 3 in. long, thick and rather stiff, scarcely pointed, lighter colored and the veins prominent beneath, smooth, the edges set with sharp, spreading, saw-like teeth: fls. usually solitary, rose-color, nearly 1 in. across, with or just preceding the lvs.: fruit small and hard, pubescent, bitter, with a large, wrinkled, sharp-pointed, somewhat cordate, unequal-sided pit. Russia and Western Asia. B.M. 161. L.B.C. 12:1114.—This plant has been introduced into this country recently as a fruit plant, although it possesses little merit for that purpose. It is cultivated in Europe for its flowers, and it has been thought that the Flowering Almond of our gardens belongs to it; but our Flowering Almonds are *Prunus Japonica* and *P. triloba*, a correction which was made in the revised edition of Gray's "Field, Forest and Garden Botany." This Russian Almond is very hardy, enduring the climate of the northern prairie states, where it ripens its little almond-like fruits in July. A small-fruited form of the Apricot (*P. Armeniaca*) has lately been introduced as Russian Almond. *Prunus nana* is cultivated in two or three forms. Var. **campéstris** has white fls. of larger size. Var. **Geórgica** has dark rose-colored somewhat smaller fls. and narrower, longer lvs. Var. **Cochinchinénsis** is a larger plant with white fls.

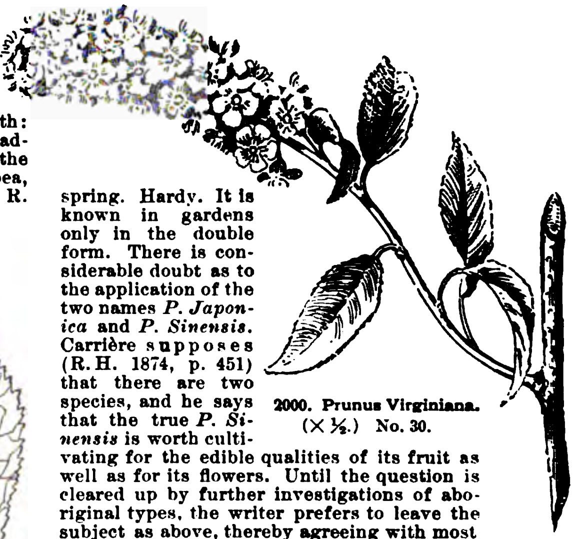
1999. Prunus Avium. (× ⅓.) No. 27.

SUBGENUS V. AMYGDALUS. Almonds and Peaches.

Fruit sessile, large, mostly pubescent: fls. solitary from lateral buds on the previous year's growth, appearing in advance of the lvs., the latter conduplicate in the bud.

A. *Plant low and bushy: Flowering Almonds.*

38. Japónica, Thunb. (*P. nàna* of American gardens. *P. Sinénsis*, Hort. *Amýgdalus pùmila*, Sims). Figs. 2002, 2003. Bushy plant, rarely over 5 ft. high: lvs. ovate-lanceolate to oblong-lanceolate, acuminate, not at all inclined to be lobed, glabrous or nearly so, very strongly veined beneath, closely and almost obtusely serrulate: fls. solitary or in 2's and 3's, rose-colored or blush, stalked (the stalks lengthening), appearing with the lvs.: fr. globular or short-oblong, ½ in. in diam., smooth and shining, wine-red. Cult. from Japan, but probably native to China. B.M. 2176. R.H. 1852:301; 1873, p. 457; 1874, p. 453; 1876:290; 1884:156; 1886, p. 416; 1887, p. 136; 1890:468. Gn. 38, p. 605; 50, p. 313.—This is the commonest Flowering Almond of our gardens, giving a profusion of attractive bloom in early spring. Hardy. It is known in gardens only in the double form. There is considerable doubt as to the application of the two names *P. Japonica* and *P. Sinensis*. Carrière supposes (R.H. 1874, p. 451) that there are two species, and he says that the true *P. Sinensis* is worth cultivating for the edible qualities of its fruit as well as for its flowers. Until the question is cleared up by further investigations of aboriginal types, the writer prefers to leave the subject as above, thereby agreeing with most writers on these plants.



2000. Prunus Virginiana. (× ½.) No. 30.

39. tríloba, Lindl. (*Amýgdalus pedunculàta*, Bunge, *Amygdalópsis Líndleyi*, Carr. *Prunópsis Líndleyi*. André). FLOWERING PLUM. Fig. 2002. Differs from the last in having broadly ovate or obovate soft-hairy lvs., which are abruptly pointed, coarsely doubly serrate, tending to be lobed above (on strong shoots): fls. solitary and mostly in advance of the lvs., pink or rose-colored, sometimes white, usually double: fr. small, red-hairy when young, but becoming glabrous. China. I.H. 8:308. F.S. 15:1532. R.H. 1862:91; 1884:396. Gn. 21, p. 275; 28:512; 55, p. 374. Gng. 5:165; 6:290; 8:196.—A most desirable bush, hardy in central New York and Ontario. It is sometimes grown as a standard by being worked on Plum, but it is then short-lived. Both this and *P. Japonica* are commonly worked on Plum, but better results are to be expected from own-rooted plants (got by layering or root-grafting).

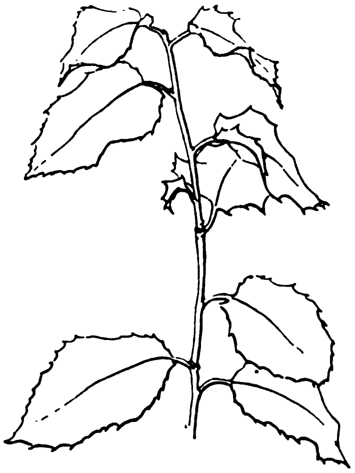
Var. **Pétzoldi** (*P. Pétzoldi*, Koch. *P. virgàta*, Hort.). Branchlets and adult lvs. glabrous, the lvs. ovate or elliptic: fls. smaller, rose-color. China.

40. **orientàlis**, Kœhne (*Amýgdalus orientàlis*, Mill. *A. argéntea*, Lam.). Shrub, 3–8 ft. high: lvs. small, nearly or quite sessile, oval, oblong or narrow obovate, nearly obtuse or short-pointed, entire: fls. solitary, nearly 1 in. across, light rose-color, with or just preceding the lvs.: fr. ovate or oblong, thinly pubescent but becoming glabrous. Asia Minor, etc. L.B.C. 12:1137.

AA. *Plant a tree or tree-like.*

B. *Fr. hard, splitting at maturity.*

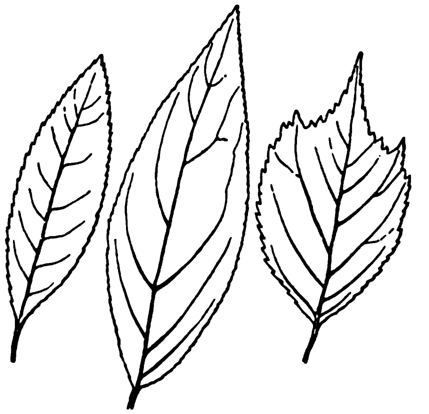
41. **Amýgdalus**, Stokes (*Amýgdalus commùnis*, Linn.). ALMOND. Figs. 63, 64. Peach-like tree, 10–25 ft. tall, with gray bark: lvs. lanceolate, firm and shining, very closely serrate: fls. large (1 in. and more across), solitary and appearing before the lvs., pink, showy: fr. a large compressed drupe with hard flesh, splitting open at maturity and liberating the pitted stone (or Almond). Asia. Gn. 50:1088 (var. *macrocarpa*); 54:1183.—Grown as an ornamental tree, but chiefly for the nuts (or pits of the fruit). There are double-fld., white-fld., and variegated-lvd. forms; also weeping forms. Var. *macrocarpa* is an early-blooming erect-growing form with fls. 2 in. across and very showy. See *Almond*.



2001. Prunus ilicifolia (× ⅓). No. 35.

BB. *Fr. soft, not opening or splitting.*

42. **Pérsica**, Sieb. & Zucc. (*Amýgdalus Pérsica*, Linn. *Pérsica vulgàris*, Mill.). PEACH. Figs. 1661–6. Much like the Almond in botanical characters and by some thought to be derived from that plant, but now generally agreed to be an original species and to be native to China: lvs. broad-lanceolate or oblong-lanceolate, coarsely serrate: fls. solitary, pink, appearing before the lvs.: fr. soft, pubescent at maturity, the stone deep-pitted and very hard. Widely cultivated, especially in North America, where it thrives under a great variety of conditions.—There are two well-marked forms, the clingstones or pavies (*Persica vulgaris* of Risso), and the freestones (*Persica domestica* of Risso). There are many ornamental forms of the Peach tree: double-fld. Fig. 1665 (F.S. 10:969; 13:1299, 1300. R.H. 1852:221); white-fld., dark-fld., etc.; purple-lvd.; variegated-lvd.; dwarfs. One of the best of these fancy forms is var. *camelliæflora*, with its subvariety *plena*, the former with very large carmine fls. and the latter with double fls. There are forms (var. *versicolor*) with different colors of fls. on different branches of the same tree.



2002. Dwarf almonds (× ⅓).
Prunus nana at left; *P. Japonica* in middle; *P. triloba* at right. Nos. 37–39.

Var. **lævis**, Gray (*Amýgdalus Pérsica necturìna*, Ait. *Pérsica lævis*, DC. *Prùnus Pérsica*, var. *necturìna*, Maxim.). NECTARINE. Fig. 1464. Fruit smooth, usually smaller: lvs. usually more strongly serrate. The Nectarine has sprung from the Peach, both through seed and bud-variation. There are two types, as in the Peach: clingstones or *brugnons* (*Persica lævis* of Risso), and freestones (*Persica violacea* of Risso). The Nectarine is not generally cultivated in this country, although it is popular in California.

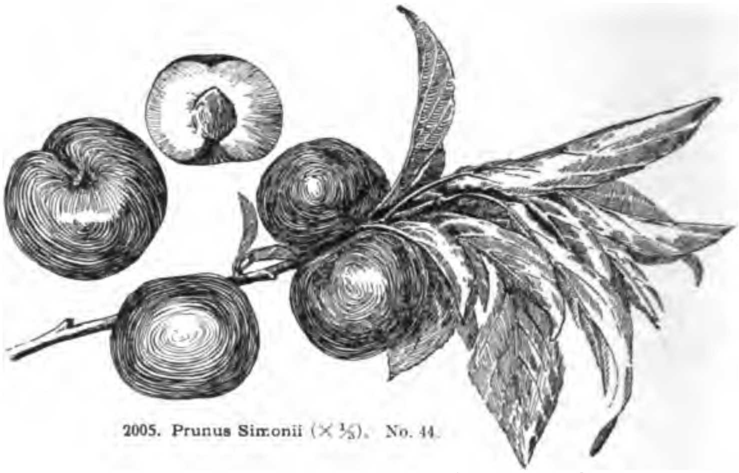
Var. **platycárpa**, Bailey (*Pérsica platycárpa*, Decaisne). FLAT PEACH, or PEEN-TO. Fig. 1660. Much flattened endwise, and scarcely thicker than the pit. From China. R.H. 1870–1:111. Trans. Lond. Hort. Soc. 4:512.—Grown in the southern states, where it has given rise to various globular Peaches. The Peen-to originated in 1869, with P. J. Berckmans, Augusta, Ga., from seeds sent from Australia, where it was probably introduced from China.

43. **Davidiàna**, Franch. (*Pérsica Davidiàna*, Carr. *Prùnus Pérsica*, var. *Davidiàna*, Dipp.). Fig. 2004. Slender, willow-like tree: lvs. narrower and smaller than those of the Peach, tapering from near the base into very long points, very sharp-serrate, light green, willow-like: fls. appearing very early, 1 in. or more across, white or blush, solitary: fr. nearly globular, the suture prominent, about 1 in. in diameter, pubescent, grayish or yellowish: stone small and nearly spherical, ruminated, free from the whitish dry flesh. China. R.H. 1872, p. 75. G.F. 10:503. Gt. 44:1412. G.C. III. 11:529. Gn. 50, p. 165.—Somewhat grown as an ornamental subject. Hardy in New York, but the flower-buds are usually killed. It blooms very early, much in advance of Peaches. By some thought to be a form of the Peach species, but as known in this country it seems to have specific characters.

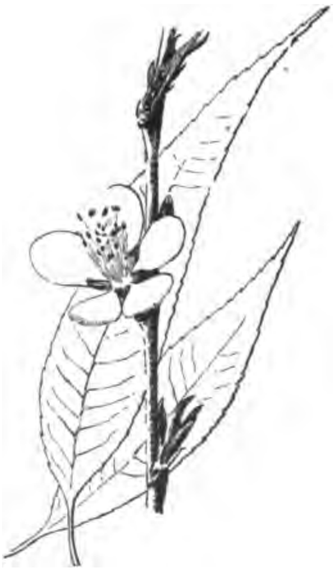
2003. Prunus Japonica. Natural size. No. 38.

44. **Simònii**, Carr. (*Pérsica Simònii*, Decaisne). SIMON or APRICOT PLUM. Fig. 2005. A straight-growing, fastigiate tree: lvs. rather long-oblanceolate or lance-obovate, rather thick and heavy, dull, very veiny below, finely but unevenly obtuse-serrate, conduplicate or trough-shaped in habit: fls. nearly white, on short

stalks, often two or three together, preceding the leaves: fr. 1 or 2 in. in diameter, flattened lengthwise, very firm in texture, perfectly smooth, handsome maroon-red, possessing a deep suture, the yellow flesh closely adhering to the small, spongy-roughened nearly orbicular pit. Named in honor of Eugene Simon, who sent pits from China to France, prior to 1872. China. R.H. 1872:110.—Introduced into the United States about 1880, or shortly after. Although much advertised by nurserymen, it has not attracted great attention from fruit-growers in the East. Upon the Pacific slope it is popular. The fruit is usually bitter, with an almond-like astringency, but sometimes it is very palatable. The tree is very hardy and vigorous somewhat north of the limit of peach-growing, but, except in the Pacific region, it does not appear to be uniformly productive. The fruit is handsome, with a pleasing odor, and it keeps a long time. The tree is conspicuous for its narrow, erect growth. The flowers are borne on short spurs on wood two and more years old; also singly on the last year's growth.



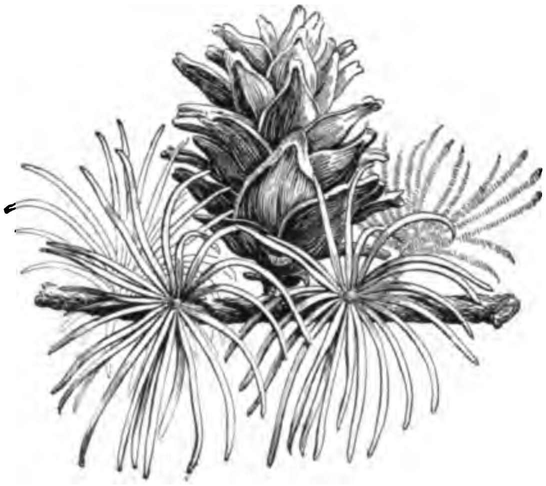
2005. Prunus Simonii (× ⅓). No. 44.



2004. Prunus Davidiana (× ½). No. 43.

P. Cocomilia, Tenore. Allied to P. cerasifera. Bush or small tree, with thorny branches: lvs. oval or obovate, tapering below, somewhat pointed, glabrous on both sides: fr. small and yellow. Italy.—*P. Grayàna*, Maxim. Allied to P. Padus. "It is a small tree, 20–30 ft. high, with a slender trunk, ample, membranaceous, long-pointed, setaceo-serrate lvs., biglandular at the base but without glands on the petioles, a peculiarity which best distinguishes this species from P. Padus, although the hair-like teeth of the leaves are characteristic and apparently constant." Sargent, Forest Flora of Japan.—*P. Jacquemóntii*, Hook. f. Subgenus Amygdalus. Dwarf (6–10 ft.), with small ovate, ovate-lanceolate or elliptic, acuminate, serrulate lvs.: fls. pink, ½–¾ in. across, solitary or in pairs, short-stalked, appearing as the lvs. burst: fr. globose, red, juicy, small. Northwestern Himalaya, 9,600 to 12,000 ft. B.M. 6976. G.C. III. 22:23. Gt. 44, p. 243 (leaf).—*P. Maáckii*, Rupr. Somewhat allied to P. Padus, but the fls. appearing on the ends of leafless shoots: fls. white, long-stalked, less than ½ in. across, the racemes 2–3 in long: lvs. lanceolate, elliptic or obovate, serrate. Manchuria.—*P. Maximòwiczii*, Rupr. Subgenus Padus: 25–30 ft.: young growth rusty-pubescent: lvs. elliptic or elliptic-obovate, long-stalked, coarsely doubly serrate: racemes glandular and bearing conspicuous bracts, appearing with the lvs.: fls. white, ⅓ in. across, stalked: fr. less than ¼ in. long, in midsummer. Japan. G.F. 6:195 and Forest, Fl. Japan 12.—*P. Miqueliàna*, Sarg. "A second species of Prunus (Fig. 37), very similar in general appearance to Prunus pendula [P. subhirtella], is confounded with it in gardens here. It has the same general habit and the same long, pendulous branches, but the bark is darker, and hardly to be distinguished from that of the common cherry tree. The fls. are corymbose on short, leafy branches, and the pedicels are conspicuously bracted at the base, and, as well as the shorter and paler calyx-tube, are covered with a few scattered hairs. The petals are more narrowly ovate than those of the last species, entire and rarely truncate, much paler pink or nearly white in color. The ovary is quite smooth, but the style is densely coated with hairs. The lvs., which appear shortly after the opening of the flowers, are broader, thinner and more deeply and irregularly cut on their margins and are only 6–8-ribbed. They are pubescent on the under side, as well as the petioles and young shoots, and have two conspicuous orange-colored glands at the base of the blade. Their larger stipules are three-lobed and glandular. The corymbose inflorescence of this plant, the forked stipules and the texture and color of the young leaves point to some form of Prunus Pseudo-Cerasus, but the style is conspicuously hairy, and I therefore very doubtfully refer it to Maximowicz's Prunus Miqueliana, authentic specimens of which, however, I have not been able to examine." Sargent, in G.F. 1, p. 196 and fig. This plant appears not to be the P. Miqueliana of Maximowicz, but a form of P. pendula (P. pendula, var. carneo, Rehd., M.D.G. 1900:320).—*P. prostràta*, Labill. Closely allied to P. incana. Very dwarf, with small round-oval lvs., whitish beneath: fls. small, bright pink, appearing with the lvs.: fr. small, ovoid, red, glabrous. B.R. 2:136. Gt. 44, p. 243 (leaf):1414. R.H. 1870–1:371.—*P. sphærocárpa*, Swartz. Evergreen, allied to P. Caroliniana: small tree: lvs. elliptic to oblong-ovate, entire: fls. small, white, in racemes shorter than the lvs.: fr. ⅓ in. or less long, orange-brown. S. Fla. to Brazil. S.S. 4:161.—*P. Ssiòri*, Schmidt. "A much more common tree [than P. Padus] in Yezo and in the elevated forests of Hondo is Prunus Ssiori, another Bird Cherry, always easily distinguished by its pale, nearly white bark. It is a handsome glabrous tree, with oblong membranaceous lvs. and long, graceful racemes of small fls., and is well worth introducing into our plantations as an ornamental plant. It also grows in Saghalin, where it was discovered by Schmidt, in Manchuria, and in western China." Sargent, Forest Flora of Japan. L. H. B.

PSEUDOLÀRIX (Greek, *pseudos*, false, and Larix; being similar to, but not a true Larch). *Coniferæ*. GOLDEN LARCH. A genus of one species, a tall, pyramidal tree with horizontally spreading whorled branches; the linear leaves appear in dense clusters on short spurs, but those of the leading shoots are scattered and spirally arranged. It is a beautiful tree with its long, spreading branches pendulous at the extremities and clothed with light green feathery foliage turning to a clear yellow in fall. The tree seems to remain free from insect pests and fungous diseases and is hardy in Mass. and probably farther north. It requires a sunny, open position and a well-drained, moderately moist soil; it does not thrive nor look well if crowded by other trees. The Golden Larch should be raised only from seeds. If grafted on its own roots or on the common Larch, as it is sometimes done, it rarely grows into a symmetrical tree. Pseudolarix is known wild only from a restricted region in N. China, where it grows in the mountains at an altitude of about 3,000 ft. It is closely allied to Larix, but differs by the stalked, pendulous, clustered, staminate fls. and by the deciduous cone-scales, which separate from the axis at maturity as in the fir.



2006. Pseudolarix Kæmpferi (× ½).

Kæmpferi, Gord Fig. 2006. (*Làrix Kæmpferi*, Fort. *Laricópsis Kæmpferi*, Kent). Tree, becoming 130 ft. high: lvs. linear-acuminate, soft, light green, bluish green beneath, 1½–3 in. long and 1–1½ lines broad: staminate fls. yellow, about ¼ in. long, slender-stalked; pistillate fls. about ¾ in. long: cone ovate, reddish brown, 2½–3 in. long, 1⅜–2 in. broad; scales triangular, ovate-lanceolate, cordate at the base, emarginate at the apex, woody: bracts ovate-lanceolate, much smaller than the scales, each scale with 2 seeds with the wings as long as the scale. F. S. 17:1777–78. R. H. 1868:331; 1871, p. 608, 609. G.C. II. 19:88. Gn. 8, p. 325; 29, p. 397. —Var. **nàna**, Beissn. Dwarf form, cult. in China and Japan; without much decorative value.

ALFRED REHDER.

PSEUDOPHŒNIX (Greek, *false Phœnix*). *Palmàceæ*. A genus of one species, a pinnate-leaved palm discovered in 1886 on one of the Florida Keys and distinguished from all other North American palms by its scarlet-orange fruit, which is about the size of a cherry. This palm is cult. in S. Calif. Generic characters: female fl. with calyx small, spreading, somewhat denticulate; petals 3, ovate, obtuse, green, bent back; staminodia 6, distinctly dark purple at the top: fr. an orange-colored drupe, stipitate, containing 1–3 globular carpels.

Sárgenti, H. Wendl. Trunk slender, 20–25 ft. high, 10–12 in. thick: lvs. abruptly pinnate, 4–5 ft. long; pinnæ lanceolate, acuminate, 12–16 in. long, bright green above, glaucous beneath, folded backward at the very base: spadix appears from among the lvs.; main and secondary branches light yellow-green and flattened: fr. usually 3-lobed, ½–¾ in. thick, bright orange-scarlet. Florida Keys. G.F. 1:353. S.S. 10:506.

F. W. BARCLAY.

PSEUDOTSÙGA (Greek *false Tsuga*). *Coniferae*. Tall evergreen trees, of symmetrical pyramidal habit, with regularly whorled branches clothed with linear flattened lvs., which are more or less 2-ranked and whitish beneath: fls. forming orange or reddish catkins: cones pendulous, medium-sized, of somewhat bristly appearance on account of the protruding bracts. The Douglas Spruce, which is the only species well known in cultivation, is one of the tallest and most important forest and timber trees of western North America, and in its forms of the higher altitudes it is hardy as far north as Canada. When it finds a congenial home it is among the most desirable conifers for park planting and it grows rapidly. It thrives best in a porous sandy loam, and its cultivation does not differ from that of *Abies* and *Picea*, which see. Varieties may be grafted on the type.

The genus has three species in W. N. America and in Japan. Pyramidal trees, closely allied and very similar in foliage to Abies, from which they are chiefly distinguished by their cones falling off as a whole at maturity, like those of Picea. The lvs. contain but one fibro-vascular bundle and are not decurrent at the base. The bracts of the cone are rather large and more or less exserted, 2-lobed at the apex, with the midrib produced into a subulate awn. Without cones the genus may be distinguished from Abies by its more slender and flexible lvs., and especially by its elongated ovate or ovate-lanceolate acute and not resinous winter-buds. The light red or yellow wood is hard and durable and much used for construction, for railway ties and for masts. The bark is sometimes used for tanning leather.

Doúglasii, Carr. (*P. mucronàta*, Sudw. *P. taxifòlia*, Britt. *P. Lindleyàna*, Carr. *Abies Doúglasi*, Lindl. *Abiètia Doúglasii*, Kent). DOUGLAS SPRUCE. RED FIR. Fig. 2007. Pyramidal tree, attaining 200 ft. and sometimes more, with a trunk becoming 12 ft. in diam. clothed with ridged dark red-brown bark: branches horizontal, with pendulous branchlets: lvs. linear, straight or curved, obtuse, slender and flexible, dark green or bluish green, ¾–1¼ in. long: staminate catkins orange, pistillate reddish: cones pendulous, oval-ovate, with broad rounded scales and much exserted bracts, 2–4½ in. long; seed ¼ in. long, with broad wing, light reddish brown. Brit. Col. to Mex., west to Mont. and Colo. S.S. 12:607. G.F. 10:295. Gn. 31, p. 288. R.H. 1868:151.—The most important of the forms in cultivation are the following: Var. **compácta**, Beissn. Of dense compact habit. Var. **fastigiàta**, Carr. (var. *sparsifòlia*, Carr.). Dense conical pyramid with numerous ascending branches and with shorter lvs. Var. **glaùca**, Beissn. With bluish green or almost silvery white foliage. Hardier than the type, but of slower growth: from Colorado. This form is best adapted for cultivation in the eastern states. Var. **glaùca péndula**, Beissn., has pendulous branches and glaucous foliage. Var. **glaucéscens**, Beissn. (*P. glaucéscens*, Bailly), is hardly different from var. glauca. R.H. 1895:88. Var. **péndula**, Neum. With pendulous branches and dark green foliage. Var. **Stairii**, Beissn. With whitish variegated foliage; of little ornamental value. Var. **taxifòlia**, Loud. Of slower growth, forming a broad dense pyramid, with longer and darker green lvs. and the cones with shorter bracts.

2007. Douglas Spruce—Pseudotsuga Douglasii (× 1-5).

P. Japónica, Beissn. (Tsuga Japonica, Shirass.). Tree, to 60 ft., similar to P. Douglasi, but lvs. shorter and broader and cones smaller, with strongly reflexed bracts. Japan. But recently introduced, and hardiness not yet proved; probably as hardy as the hardier forms of P. Douglasi.—*P. macrocárpa*, Mayr (P. Douglasi, var. macrocarpa, Engelm.). Tree, to 60 or 80 ft., with remote and usually pendulous branches: lvs. acute, bluish gray: cones 4–6½ in. long, with shorter bracts; seeds ⅓ in. long. S. Calif. S.S. 12:608. G.F. 10:25. Seems not yet introduced; not hardy north, and inferior.—*P. Davidiàna*, Bertr. =Keteleeria Davidiana, Beissn., and *P. Jezoensis*, Bertr.=Keteleeria Fortunei, Carr. Keteleeria certainly constitutes a distinct genus and cannot be united with either Abies, Picea, Tsuga or Pseudotsuga. It is chiefly distinguished by the staminate fls. being arranged in clusters like those of Pseudolarix, but are only short-stalked: cones upright, with persistent scales; bracts enclosed, half as long as the scales: lvs. similar to those of Abies but pale green, not whitish beneath, pointed or obtuse, rigid. In old age the head becomes broad and flat-topped as in Cedrus Libani, in young trees it is regular, pyramidal, with whorled branches. The germination is very different from that of most other conifers, but similar to Ginkgo and Araucaria, as the two cotyledons remain in the ground inclosed in the seed and do not become green. None of the 3 or 4 Chinese species seems to be in cultivation in this country, where they would probably not be hardy north of the middle states, but P. (Keteleeria) Fortunèi, Carr., has been successfully cult. in S. Europe. The lvs. of this species are about 1 in. long, rigid, pointed on the lower branches, obtuse on the upper ones: cone 3–6 in. long. F.S. 7, p. 223 (as P. Jezoensis). R.H. 1866:451. Prop. by seeds, layers and cuttings and by grafting on Abies Picea; it will probably also grow grafted on Pseudotsuga.

Alfred Rehder.

The Douglas Spruce is a tree for the million. It would be difficult to overrate its beauty. As a forest tree it perhaps produces a greater crop of lumber per acre than any other species. It probably grows faster than any other conifer. Indeed, the complaint is sometimes made that it grows too fast to make a compact lawn tree. It is desirable to have groups of Douglas Spruce, because the foliage is so soft that single specimens are sometimes injured by high winds. Specimens planted on the prairies without protection from hot winds may sometimes have their buds injured by late spring frosts. It is, of course, a mistake to use the Douglas Spruce for a wind-break. The Douglas Spruce is generally prop. by seeds. Seeds of conifers gathered on the Pacific slope are tender, while those gathered in Colorado produce hardy trees which endure both drought and cold. Unlike the firs, the Douglas Spruce has fine, fibrous roots like the Norway Spruce and transplants as readily. The writer has transplanted many stocky young trees growing in the open to the nursery and has saved 90 per cent of them. They seemed to thrive as well as nursery-grown Norway spruces of the same size. The yield of seed from a wagon-load of cones is light, and it is somewhat difficult to grow seedlings. In some circumstances it will be cheaper in the end to procure young trees. The Douglas Spruce is remarkable for its wide variation in form and color. The needles may be short or long, light green, dark green, or have a bluish or silvery cast. The deep blue and silvery foliage is characteristic of the deep gorges of high altitudes.

C. S. Harrison.

We have found the Douglas Spruce one of the easiest of all conifers to grow from seed. However, the seed rapidly loses its germinating powers, in this respect partaking of the firs more than of the spruces. As it is now being grown and disseminated, it is not to be recommended for general planting. Seed from trees growing in the valleys and foothills of Colorado will not produce trees that are hardy north of the Ohio river. As trees growing in those localities are easy of access, a larger part of the seed is collected from them. There is considerable difference between trees grown from valley and mountain seeds. The former have short green leaves and a stunted look, compact growth, showing none of the bold and striking effect of those from a high elevation. The latter have longer leaves, more glaucous appearance and great rapidity of growth. The valley trees brown in winter; the mountain trees do not. Many of the latter have a spreading and weeping habit, partaking more of the characteristic of the hemlock. The valley trees have more of the habit of *Picea orientalis*, but not as good color. Unless more care is taken in collecting seeds of this tree, it will soon fall into disrepute.

Thos. H. Douglas.

PSÍDIUM (Greek, *psidion*, the pomegranate). *Myrtàceæ.* About 130 species of evergreen trees and shrubs. Lvs. opposite, petiolate, penniveined: fls. rather large, white, cymose on axillary or lateral, 1–3- (rarely many-) fld. peduncles; calyx 4–5-lobed, the lobes persistent; petals 4 or 5, spreading: berries globose, ovoid or pear-shaped, usually roughish, often crowned with the calyx limb; seeds subreniform, hard. Natives of tropical and subtropical America; some species have become naturalized in tropical Asia and south Africa. Prop. easily by suckers, cuttings or seeds.

INDEX

(s. l. refers to supplementary list.)

Araca, 2.
Cattleianum, 4.
Guajava, 1.
Guava, 1.
Guayavillas, s. l.
Guineense, 3.
lucidum, 4.
polycarpum, s. l.
pomiferum, 1.
pyriferum, 1.
pyriforme, 1.
sapidissimum, 1.
Sinense, s. l.
Thea, s. l.

A. *Branchlets 4-angled.*

1. **Guajàva**, Linn. (*P. pomíferum*, Linn. *P. Guàva*, Raddi). Lemon Guava. Fig. 2008. Shrub or small tree, 6–15 ft. high: lvs. oval to oblong-lanceolate, bluntish, chartaceous, glabrous above, puberulent below: peduncles 3 to many-fld., pubescent: fr. globose, yellow, aromatic, somewhat astringent. June. Grown in S. Calif. and valued for jellies and preserves: several horticultural varieties are offered by nurserymen. Var. **sapidissimum**, Jacq., has similar fruit but only 1-fld. peduncles. Becomes a troublesome weedy plant in moist tropical countries.

Var. **pyriferum**, Linn. (*P. pyríferum*, Linn. *P. pyrifórme*, Griseb.). Common Guava. Small tree: lvs. acute: peduncles 1-fld.: fr. small, pear-shaped, smooth-skinned, yellowish when ripe, aromatic, sweet and pleasant to the taste. Fls. May–July: fr. July–Nov. B.R. 13:1079.—The source of the well-known Guava jelly of the West Indies. The fresh fruit makes excellent tarts after removing the small stony seeds. To be eaten raw, it is best gathered in the early morning, according to Lindley, as it is then more agreeably acid.

AA. *Branchlets terete.*

2. **Aràca**, Raddi. Brazil Guava. Shrub 4–6 ft. high: branchlets hirsute: lvs. oval or oblong, obtuse, above sub-velutinous to the touch, beneath pubescently sub-hirsute; veins reticulate, somewhat raised: peduncles axillary, 1–3-fld.: fr. ovoid, greenish yellow; flesh white. Dry uplands of Brazil.—Offered by two or three dealers, and said to be one of the very best Guavas.

3. **Guineénse**, Swartz. Guiana Guava. Shrub 8–10 ft. high: branchlets pubescent-villous: lvs. ovate, glabrous above: petioles and under side rusty-tomentose: peduncles 1–3-fld.: fr. subrotund, subpubescent, deep yellow outside; flesh red, said to possess an exquisite flavor.

4. **Cattleiànum**, Sabine. Strawberry Guava. Shrub or small tree, 10–20 ft. high: branchlets glabrous: lvs. opposite, obovate, coriaceous, glabrous, dark green: peduncles axillary, opposite, solitary, 1-fld., scarcely equaling the petioles: fr. nearly spherical, about 1 in. long, of a fine deep claret color, with a tough foveolate skin, resembling that of a ripe fig, but thinner; pulp fleshy, soft and juicy, purplish red next the skin but white at center, sweet and acid, with a strawberry-like fragrance and flavor, hence the popular name. May. Brazil. B.R. 622. B.M. 2501. N. 3:238.—Extensively cultivated in S. Calif.; hardy outdoors near San Francisco and probably northward. Var. **lùcidum** (*P. lùcidum*, Hort.). Yellow Strawberry Guava. Has a larger yellow fruit, said to have a better taste than the purple-fruited form. Reported as being cultivated extensively in Florida; grown in S. Calif. by Franceschi.

P. Guayavillas, Hort. "Brazil; a distinct-looking species, said to have smaller fruit than P. Guajava but of superior taste,"= P. Cujavillas] Burm. (?), which has been reduced to a form of P. Guajava.—*P. polycárpum*, Lamb. Small shrub with branchlets terete, hirsute: lvs. subsessile, ovate-oblong, acute, pubescent above, scabrous and rugose beneath: peduncles 3-fld.: fr. yellow within, edible, considered superior in flavor to the common Guava, but rarely larger than a cherry. S. Amer. and W. Indies.—*P. Sinénse*, recently introduced by Mr. Swingle, agricultural explorer for the U. S. Dept. of Agriculture, not yet seen by us.—*P. Thèa*, Griseb. Argentina. Another recent introduction by Mr. Swingle.—Several other euible-fruited species are known, but are not introduced in this country.

Jos. Burtt Davy.

PSORÀLEA (Greek, *warty;* referring to glands on the foliage). *Leguminòsæ*. Scurfy Pea. A genus of about 110 species of herbs, shrubs or subshrubs widely scattered about the world, 30 being North American. Lvs. glandular-dotted; lfts. 3 to many and digitate or 3 and pinnate: fls. purple, blue, rose or white, in racemes or spikes; calyx not enlarged after flowering: standard ovate or orbicular, clawed; wing oblong or falcate; keel incurved, obtuse: ovary sessile; pod ovoid, short, indehiscent, 1-seeded. Useful border plants.

A. *Plants hardy.*

B. *No. of lfts. 7.*

subacaùlis, Torr. & Gray. Perennial herb, stemless or nearly so, about 1 ft. high, with numerous, usually purple fls. in ovate or oblong, dense spikes: lfts. 7, digitate, obovate-oblong, 1 in. long: fl.-stem longer than lvs., rigid. April–June. Rocky hills, Tenn.

BB. *No. of lfts. 3.*

C. *Lvs. digitately compound.*

lanceolàta, Pursh. Perennial herb, much branched, glabrous or nearly so, densely dark-glandular, 1–2 ft. high: lfts. sessile, bright green, entire, linear or oblanceolate: fls. bluish white, 3 lines long. June, July. Kan. to N. W. Territory, west to Wash., etc. B.B. 2:281.

CC. *Lvs. pinnately compound.*

physòdes, Dougl. Perennial herb, slender, 1–2 ft. high: lfts. ovate, about 1 in. long: fls. in short, close racemes; calyx ¼ in. long, becoming enlarged and inflated until nearly ½ in. long; corolla ¼ in. long, white or purplish. Mts. of coast ranges, U. S.

BBB. *No. of lfts. 5.*

esculénta, Pursh. Pomme Blanche. Hardy herbaceous perennial 4–18 in. high: lfts. 5 and digitate, short-stalked, oval or obovate, entire obtuse, narrowed at base, 1–2 in. long: fls. bluish: spikes dense, 1½–3 in. long: root large, often clustered, starchy. June. Prairies, Manitoba and Dakota south. B.B. 2:284.

AA. *Plants tender, cult. in S. Calif.*

B. *No. of lfts. 3.*

C. *Habit herbaceous.*

bituminòsa, Linn. Perennial herb, 1½–3 ft. high, appressed hirsute: lfts. nearly entire; lower ones ovate, obtuse; upper ones much narrower, acute: peduncles longer than lvs.; fl.-heads dense, involucrate, becoming elongated in fruit: fls. nearly 1 in. long. Spring and early summer. Poor soil, Arabia.

CC. *Habit shrubby.*

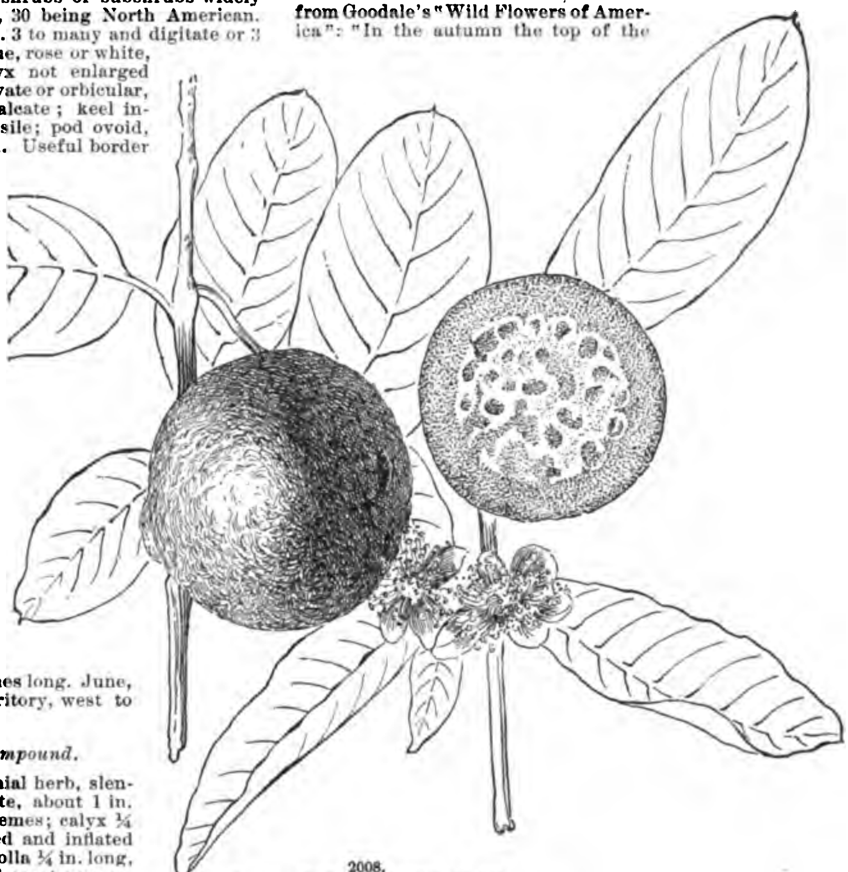
glandulòsa, Linn. Petioles scabrous: lfts. 3, digitate, ovate-lanceolate, acuminate: fls. blue and white, in usually axillary racemes. Chile and Peru. B.M. 990.

BB. *No. of lfts. 7–11.*

pinnàta, Linn. Arborescent or shrubby, 6–12 ft., densely branched and leafy: lfts. 7–11, pinnate, linear or lanceolate-linear, acute, commonly 10–15 lines long by about 1 line wide: fls. axillary, solitary or clustered, sessile or pedicelled, blue with white wings. S. Africa. G.C. III. 5:693. J.H. III. 33:591.

The following points concerning the Pomme Blanche (which is also called Prairie Apple, Prairie Turnip and Indian or Missouri Bread-root, are taken from Goodale's "Wild Flowers of America": "In the autumn the top of the plant dies and separates from the root, near the ground, and is blown about the prairies. After the top has gone the root cannot be readily found, and hence the Indians dig them in August for their winter use. The root lies deep in the ground and is about the size of a hen's egg. The outside is covered with a thick integument almost as tough as wood and of a dark brown color. The inside is whitish and not unlike a chestnut in appearance and taste, but not so sweet. The Indian women dig the roots with great facility by means of a pointed stick two or three feet long." The roots are spindle-shaped or turnip-shaped. If the Indians use them immediately, they generally roast them in ashes. They are also dried and stored for winter, and when wanted they are mashed between stones, mixed with water and baked into cakes over the coals. The root was frequently found in the canoes of the Indians by early travelers before the plant which produced it was known to white men. Nuttall wrote: "The taste is rather insipid, but not disagreeable either raw or boiled. Texture laminated, always tenacious, solid and never farinaceous." In 1846 the Pomme Blanche was proposed as a substitute for the potato. Its claims to consideration are discussed in "Comptes rendue de l'Academie des Sciences," vols. 26, 29 and 30, and in "Le Potager d'un Curieux," by Pailleux and Bois, with the result that it is believed to offer no possibilities of advance over the potato.

F. W. Barclay.



2008. Guava—Psidium Guajava (× ½).

PSYCHÒTRIA (Greek, *life-preserving;* referring to medicinal properties). *Rubiàceæ.* About 500 tropical or subtropical shrubs, small trees or rarely herbs bearing small fls. in terminal or rarely axillary, corymbose, paniculate or head-like cymes: lvs. opposite or rarely whorled: calyx-limb short, various, often 5-toothed: corolla usually short, 5-, rarely 4-lobed: fr. a drupe with 2 smooth hemispherical stones. Grumilea, which differs only in having ruminate albumen, is included in this genus.

A. *Fls. yellow.*

Capénsis, Vatke (*Grumìlea Capénsis,* Sond.). An evergreen shrub or tree with shining lvs. 3–5 x 1½–2 in. and fls. in trichotomous, pedunculate corymbs: stipules coriaceous, broad: pedicels appressed, hairy, bracteated at the base; ultimate pedicel bearing a 6–12-fld. umbel: calyx ½ line long: corolla 3 lines long, yellow: fr. black. S. Africa. Cult. in S. Fla.

2009. Psychotria undata. (× ⅙)

AA. *Fls. white.*

undàta, Jacq. Fig. 2009. A glabrous shrub; lvs. papery, elliptical, costate-veiny: stipules large, connate, dimidiate-sheathing, obovate: panicle sessile, trichotomous, much exceeded by the lvs.: fls. clustered, white; corolla-lobes shorter than tube. Bahama, Jamaica.

P. jasminiflòra, Mast. Shrubby: bark whitish: lvs. 3 in. long, coriaceous, pale beneath: nerves obscure: fls. white, 1–1¼ in. long. Braz. G.C. II. 12:201. B.M. 6454.

F. W. Barclay.

PTÆRÓXYLON (Greek, *sneeze-wood*). *Sapindàceæ.* *P. utile,* or Sneezewood, is a forest tree of great value in South Africa. It has been introduced to S. California by Dr. F. Franceschi, Santa Barbara, who sends the following notes mainly taken from C. C. Henkel's "Tree Planting in the Transkeian Territories": It is a tree 30–50 ft. high, with a straight trunk 2–4 ft. in diam. and a beautiful crown: wood extremely heavy and hard, strong, tough, close-grained, inelastic, very durable in contact with the ground, easily split; used for piles of bridges and jetties, for trucks and wagons, doors and window frames, fence-posts and lately for engraving. It burns readily even when green. It takes a fine polish like mahogany. Dr. Franceschi writes that the seed possesses short vitality. Of several thousand seeds received from Kew a few years ago not one germinated. Another large consignment was received two years ago from the Cape, but only a few seedlings have been successfully raised so far. The tree is called Sneezewood because of its pungent odor.

Generic characters: fls. polygamously diœcious; sepals 4, obtuse; petals 4; disk hypogynous, annular, glandular; stamens 4, alternate with the petals; styles 2, or connate in one: capsule compressed, 2-lobed at apex, cordate at base, 2-celled, 2-seeded.

ùtile, Ecklon & Zeyher. Sneezewood. Lvs. opposite; lfts. 11–17, decreasing, entire: racemes axillary, shorter than lvs.: fls. small, white or yellowish. S. Afr.

W. M.

PTÁRMICA. Included with *Achillea.*

PTÈLEA (Greek name of the Elm tree, transferred to this genus on account of the similarity of the fruits). *Rutàceæ.* Hop Tree. Ornamental deciduous shrubs or trees with alternate, long-petioled, usually 3-foliolate lvs. and greenish white fls. in loose terminal corymbs, followed by flattened usually broadly winged and nearly orbicular fruits. The one species chiefly cult. is hardy north—if it proves tender, as it sometimes does, it is probably raised from southern seed—and is a small, round-headed, rather loosely branched tree with glossy green foliage, adorned in fall with numerous clusters of light green fruits which remain on the branches for some time after the lvs. have fallen. It thrives best in a porous, moderately moist soil and prefers a somewhat shaded position. Prop. by seeds sown in fall; the varieties by layers or by grafting in spring under glass or budding in summer on seedlings of the type.

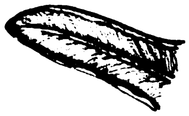
The genus has 4 or 5 species in North America, south to Mexico. Lvs. estipulate, 3–5-foliolate; lfts. entire or crenulate, punctate with pellucid dots: fls. small, polygamous, in terminal corymbs; lobes of the minute calyx, petals and stamens 4–5: ovary flattened, 2-celled, with short style: fr. a 2-seeded, indehiscent, small flattened nut, furnished usually with a broad thin wing. Bark and foliage are sometimes used medicinally and emit (as well as the fruits) when bruised, a strong, pungent odor resembling somewhat that of the hop, for which the frs. are said to have been used as a substitute—hence the name Hop Tree.

trifoliàta, Linn. Hop Tree. Wafer Ash. Fig. 2010. Shrub or small round-headed tree, attaining 25 ft.: lfts. 3, sessile, ovate to elliptic-oblong, narrowed at both ends, sometimes acuminate, the lateral ones unequal at the base, crenulate or entire, dark green and lustrous above, pale below, glabrous or pubescent when young, 3–5 in. long: fls. ⅛–¼ in. across; filaments villous below: fr. about 1 in. long, broadly winged. June. N. Y. to Fla., west to Minn. S.S. 1:33, 34. G.C. III. 16:375. Several varieties are in cultivation, of which var. **àurea,** Hort. (*P. àurea,* Hort.), the Golden Hop Tree, with yellow foliage, is the best known. Var. **glaùca,** Kirchn. (? var. *pubéscens,* Pursh). Lvs. grayish green, pubescent when young. Var. **móllis,** Torr. & Gray (*P. móllis,* Curtis. *P. rhombifòlia,* Heller). Branchlets, inflorescence and lvs. beneath pubescent or tomentose. N. C. and Fla. to Ariz. More tender than the northern glabrous form and rarely cultivated.

P. angustifòlia, Benth. (P. Baldwini, Torr. & Gray). Shrub, attaining 25 ft., with smaller and narrower lfts., 1–2½ in. long: fls. larger: fr. with narrower wing, emarginate at the base. S. C. to Fla., and Tex. to Colo., Calif. and Mex.—*P. áptera,* Parry. Shrub, attaining 15 ft.: lfts. very small, becoming 1 in. long: corymbs few-fld.: fr. wingless or nearly so. Calif. G.F. 3:333. Both last named species are not hardy north.

Alfred Rehder.

PTERÍDIUM (Greek, *with the form of Pteris*). *Polypodiàceæ.* A genus of large, ternately divided ferns commonly known as Bracken or Brakes, with the sporangia borne on a marginal line-like receptacle as in Pteris (Fig. 2011) and covered with a marginal indusium, but with an additional membranous indusium within the receptacle. Commonly known as Pteris.



2011. Fruiting pinnule of common brake.—Pteridium aquilinum. Natural size.

aquilinum, Kuhn. Lvs. scattered from an underground rhizome, 2–9 ft. high, ternately compound. Field and waste places in some of its forms throughout the world. L. M. UNDERWOOD.

PTÈRIS (Greek name for a fern, from a word meaning *wing;* alluding to the prevalence of pinnate forms). *Polypodiàceæ.* A large genus of widely distributed ferns with the sporangia borne on a marginal line-like receptacle that connects the free ends of the veins, and with the more or less altered margin of the leaf rolled over to form a continuous indusium. Many of the forms are among the commonest species of ferns in the trade and are quite generally used for table decoration. For culture, see *Fern.*

INDEX.

S. L. refers to supplementary list.

adiantoides, S. L.
albo-lineata, 2.
angustata, 3.
aquilina, S. L.
argyræa, 7.
Bausei, 6.
biaurita, 11.
Cretica, 2.
Chinensis, S. L.
cristata, 3, 11.
densa, 3.
ensiformis, 4.
geranifolia, S. L.
Gilbertii, 3.
hastata, S. L.
heterophylla, 8.
inequalis, 5.
internata, 8.
leptophylla, 13.
longifolia, 1.
magnifica, 2.
major, 2.
maxima, 11.
Mayii, 2.
nemoralis, 11.
nobilis, 2.
Ouvrardi, 3.
palmata, S. L.
plumosa, S. L.
quadriaurita, 7.
regina, S. L.
scaberula, 10.
semipinnata, 6.
serrulata, 3.
Sieboldii, S. L.
Smithiana, 9.
Smithii, 9.
Suorardii, S. L.
tremula, 9.
tricolor, 7.
variegata, 9.
Victoriæ, 4.
voluta, 3.
Wallichiana, 12.
Wimsetti, S. L.

A. *Veins free throughout.*
B. *Lvs. simply pinnate, the lower pinnæ not divided* .... 1. **longifolia**
BB. *Lvs. simply pinnate, but the lower pinnæ forked* .... 2. **Cretica**
3. **serrulata**
4. **ensiformis**
BBB. *Lvs. with lowest pinnæ pinnate.* 5. **inæqualis**
6. **semipinnata**
BBBB. *Lvs. with lowest pinnæ bipinnatifid.*
C. *Lowest pinnæ enlarged* ...... 7. **quadriaurita**
8. **heterophylla**
9. **tremula**
CC. *Lowest pinnæ not enlarged* ..10. **scaberula**
AA. *Veins free, except for a single low arch next the midvein* ....11. **biaurita**
12. **Wallichiana**
AAA. *Veins uniting, forming copious meshes* ....13. **leptophylla**

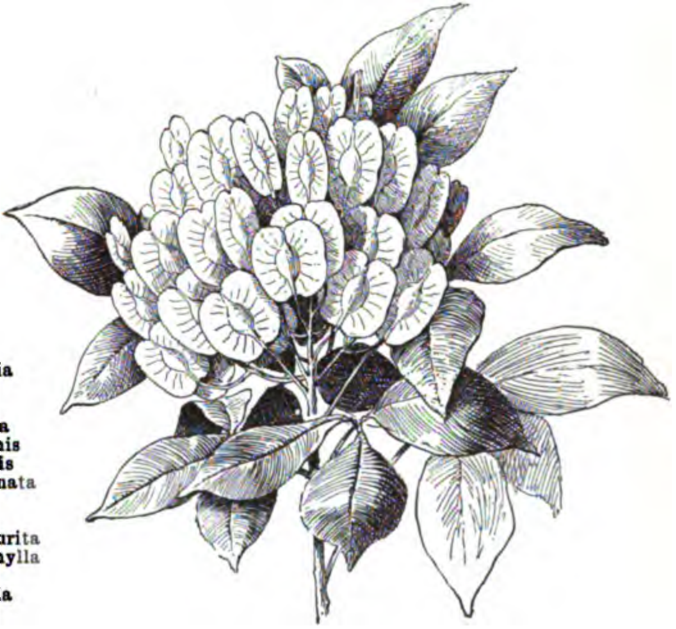
1. **longifòlia,** Linn. Lvs. 1–2 ft. long, 4–9 in. wide, lanceolate, often narrowed below; pinnæ 20–30 on each side, linear, entire. Tropical regions all around the world, extending to southern Florida. Var. **Màriesii,** Hort. Fronds shorter and pinnules straighter, the plant keeping closer to the pot; a good horticultural form.

2. **Crética,** Linn. Lvs. 6–12 in. long, on slender, straw-colored stalks, consisting of a terminal pinna and 2–6 opposite sessile pairs, the upper often decurrent, the lower pairs cleft nearly to the base into 2 or 3 pinnules. Quite generally distributed in tropical regions, extending to central Florida. Many varieties are in cult.. of which var. **albo-lineàta,** Hort. (Fig. 2012), is one of the finest, with broader pinnæ and a broad, central, whitish band. Var. **màjor** and var. **nóbilis** are larger horticultural forms, and var. **magnifica** and var. **Màyii** (*P. Màyii*) are still more developed.

3. **serrulàta,** Linn. f. Lvs. 3–12 in. long, on slender brownish stalks, consisting of a terminal pinna and 5–6 pairs of lateral ones, the upper ones decurrent and the lower forked into 2 or 3 branches or with second branch above the basal one; pinnæ narrow, the indusium not extending to the apices, which are sharply serrulate. China and Japan.—Many monstrous and distorted forms appear in cult., giving rise to such varietal names as **angustàta, cristàta, cristàta nàna compácta, cristàta variegàta, dénsa, Gilbertii, Ouvrárdi** (*P. Ouvrardi,* Hort.), **volùta,** etc., but these cannot be regarded as true varieties in any scientific sense.

4. **ensifórmis,** Burm. Lvs. of 2 sorts, the sterile with elliptic or elliptic-lanceolate segments, the lower pinnæ 5–7-parted, the upper gradually simpler; sporophylls similar but taller and with longer and much narrower divisions. India to Polynesia; often confused with the preceding species, as both are more or less common in cult. Var. **Victòriæ** (*P. Victòriæ,* Hort.) is a garden variety with leaves variegated with white.

5. **inæquális,** Baker. Lvs. ovate-deltoid, 18–24 in. long, 10–15 in. wide, with 4–5 pairs of pinnate or pinnatifid pinnæ followed by 2–3 pairs of broadly linear simple ones and ending in a long, terminal, irregularly pinnatifid portion; divisions of the lower sides of the pinnæ uniformly much longer and larger than the upper ones. China and Japan.



2010. Ptelea trifoliata, the Hop Tree, in fruit (× ½).

6. **semipinnàta,** Linn. Lvs. 12–18 in. long, the upper portion simply pinnate with decurrent pinnæ, the 4 or more lowest pinnatifid on the lower side, the upper side of the secondary rachises bordered by a narrow lamina. India, China, Japan and the East Indies.—Var. **Baùsei,** (*P. Baùsei,* Hort.) is a garden form.

7. **quadriaurita,** Retz. Lvs. up to 2–3 ft. long, on strong, pale stalks, with a terminal central pinna cut down to the rachis into numerous linear-oblong lobes, and below this several similar pinnæ on each side, the lowest of which are usually again compound with similar but smaller ones branching from the lower side at base. All tropical regions.—Var. **argyræa** (*P. argyræa,* Moore) is a form with a white band down the centers of the pinnæ. Var. **tricolor** (*P. tricolor,* Linden) is similar but has a tinge of red in addition.

8. **heterophylla,** Linn. Lvs. 6–8 in. long, on pale stalks, of 2 sorts; sterile lvs. elliptic, deeply incised; sporophylls narrowly linear-elliptic, with broad indusia and sterile apices ending in 2–3 teeth; both sorts bipinnate in the lower portions. West Indies to Brazil. Sometimes referred to a distinct genus, Anopteris. Var. **internàta** (*P. internàta,* Moore) is a garden variety with smaller sporophylls and broader segments.

9. **trémula,** R. Br. Lvs. 2–4 ft. long, on polished chestnut-brown stalks; upper pinnæ simply pinnate, lower often much compound: sori copious, sometimes filling up the whole segment except the rachis. Australia, New Zealand.—Many forms occur in cult. as var. **Smithiàna** (*P. Smíthii*, Hort.), **variegàta,** etc.

2012. Pteris Cretica, var. albo-lineata.

10. **scabérula,** Richard. Lvs. 12–18 in. long, on brownish scabrous stalks, lanceolate-ovate in outline, tripinnate or quadri-pinnatifid throughout; rachis flexuous, scabrous; sori at maturity covering nearly the entire surface of the narrow lanceolate segments. New Zealand.

11. **biaurita,** Linn. (*P. máxima*, Baker. *P. nemoràlis*, Willd.). Lvs. 15–30 in. long, with a terminal pinna 6–9 in. long cut into narrow round-pointed divisions on 7–10 pairs of similar lateral ones, the lowest pair bearing a fork on the lower basal side. All tropical regions.—Habit very like *P. quadriaurita*, from which it differs chiefly in the venation. Var. **cristàta** (*P. máxima*, var. *cristàta*, Hort.) is a cult. form.

12. **Wallichiàna,** Agardh. Lvs. tripartite, with the lateral divisions again forked, the central one reaching 2 ft. long, with numerous lanceolate sessile opposite pinnules, cut again into numerous narrow lobes one-eighth in. wide. India, Japan and the Philippine Islands.

13. **leptophýlla,** Swz. Lvs. deltoid, 9–12 in. each way, on straw-colored stalks; upper pinna simple, those below pinnatifid to a winged rachis, the lowest similarly bipinnatifid at the base; veins fine; sori not reaching the tips of the segments. Brazil.

The following are mostly synonyms and trade names that cannot be accounted for by the writer: *P. adiantoìdes*.—*P. aquilìna*. See Pteridium.—*P. Chinénsis* is possibly a var. of P. serrulata.—*P. geranifòlia* is a species of Doryopteris.—*P. hastàta* = Pellæa hastata.—*P. palmàta* possibly referable to Doryopteris.—*P. plumòsa*.—*P. regina*.—*P. Sieboldii*.—*P. Suorárdii*.—*P. Wimsetti*.

L. M. Underwood.

PTEROCÀRYA (Greek, *pteros*, wing, and *karya*, nut; referring to the winged nuts). *Juglandàceæ*. Ornamental deciduous trees, with large, alternate, pinnate lvs., rather inconspicuous greenish fls. in pendulous catkins, and long, pendulous racemes of small, winged fruits. The three cultivated species are hardy as far north as Massachusetts, except some tender varieties of *P. stenoptera*. They are handsome trees of rapid growth, with graceful dark green foliage, decorated in summer and fall with the long, drooping racemes of light green fruits. They thrive best in rich and moist soil, but also grow in drier localities. Propagated by seeds sown in fall or stratified, and by layers and suckers.

A genus of about 7 species in the Caucasus region, China and Japan. Branches with lamellose pith: lvs. odd-pinnate, with almost sessile lfts.: fls. monœcious, in pendulous catkins, appearing with the lvs.; staminate catkins rather dense, fls. consisting of 3 connate bracts, 1–4 sepals and 6–18 stamens; pistillate catkins slender, the 1-celled ovary enclosed in a connate involucre elongated into a 4-toothed beak, stigmas 2: fr. a small 1-seeded, winged nut, 4-celled at the base. In germination the 4-lobed cotyledons are borne above the ground and become green, while in Juglans and Hicoria they remain inclosed in the nuts.

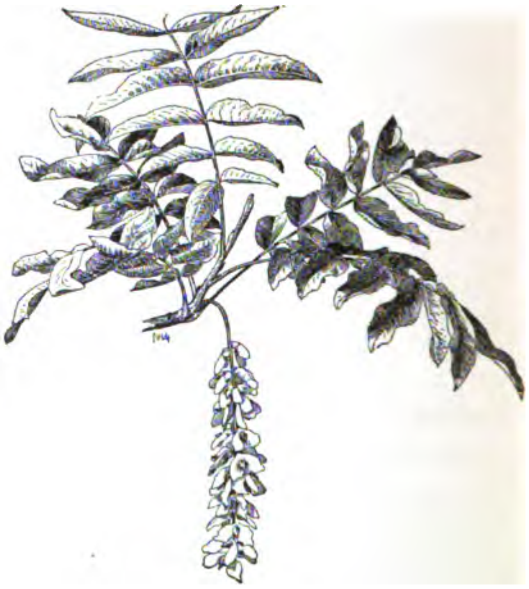
A. *Winter-buds naked, usually several in each axil.*

fraxinifòlia, Spach. (*P. Caucásica*, C. A. Mey.). Tree, to 60 ft., with spreading branches, often rising in several stems from the ground: lvs. 8–15 in. long, with glabrous terete rachis; lfts. 11–25, oblong to oblong-lanceolate, acute or acuminate, serrate, pubescent only in the axils of the veins beneath, 2–4 in. long: stamens 10–16: fr. with semi-orbiculate wing, about ¾ in. broad, in racemes to 18 in. long. W. Asia. Gn. 34, p. 219. G.C. III. 4:381.—*P. Spachiàna*, Lav. (*P. dumosa*, Lav.), is hardly different, except that it is more shrubby and tender.

stenóptera, DC. (*P. Sinénsis*, Hort. *P. Japónica*, Hort.). Fig. 2013. Tree, similar to the preceding: lvs. 6–12 in. long, with the rachis winged and pubescent beneath; lfts. 11–21, oblong, acute, serrate, pubescent beneath on the midrib, 2–4 in. long: stamens 6–10: fr. with oblong or oval-oblong, usually upright wings diverging at a narrow angle. China.—This is a variable species, and the varieties are of different degrees of hardiness. The form cultivated in the Arnold Arboretum has proved as hardy as the preceding species.

AA. *Winter-buds covered with 2–3 dark brown, large scales, falling off early in spring: accessory buds wanting.*

rhoifòlia, Sieb. & Zucc. (*P. sorbifòlia*, Sieb. & Zucc. *P. lævigàta*, Hort.). Tree, attaining 80 ft., with spreading branches: lvs. 8–15 in. long, with terete-pubescent or almost glabrous rachis; lfts. 11–21, oblong or oblong-lanceolate, acuminate, pubescent on the veins beneath or almost glabrous, 2–4 in. long: fr. with a broad rhombic wing, about 1 in. across. Japan. S.Z. 2:150.—This species is an important forest tree in Japan and has proved hardy at the Arnold Arboretum.



2013. Pterocarya stenoptera (× 1-5).

Alfred Rehder.

PTEROSPÉRMUM (Greek, *winged seed*). *Sterculiàceæ.* A genus of about 15 species of trees or shrubs from tropical Asia. Lvs. 2-ranked, leathery, simple or lobed: peduncles 1–3, terminal: bractlets entire or laciniate, persistent or not: sepals 5, more or less connate; petals 5, deciduous with calyx: staminal column short, bearing 3 linear, 2-celled anthers between each pair of the 5 ligulate staminodia: ovary inserted at summit of staminal column, 3–5-celled; style entire; stigma 5-furrowed; ovules many: capsule somewhat woody, terete or 5-angled. Flora of British India 1:366.

acerifòlium, Willd. Large tree: lvs. 10–14 in. x 6–12 in., roundish or oblong, often lobed, palmately 5–7-nerved; nerves prominent beneath: bractlets laciniate: fl.-buds oblong, obtuse, 5-angled, rusty tomentose: fls. 5–6 in. across, pure white, fragrant; sepals linear-oblong, thick; petals linear-oblong: capsule 4–6 in. long, 5-celled; seeds many; wing large, thin. B.M. 620. Cult. in S. Calif.

F. W. BARCLAY.

PTEROSTÝRAX (Greek, *pteros*, wing; alluding to the winged or ribbed fruit, by which it is distinguished from the allied genus Styrax). *Styracàceæ.* Ornamental deciduous trees, with rather large, alternate, denticulate lvs. and white fls. in showy pendulous panicles, followed by small rather inconspicuous fruits. They are only precariously hardy as far north as Mass. in sheltered positions. In June they are very attractive, with their graceful drooping panicles of numerous deutzia-like fragrant flowers. They thrive best in a moderately moist sandy loam and are prop. by seeds or layers and also by greenwood cuttings under glass. About 3 species in China and Japan. Small trees: fls. in large panicles terminal on short branchlets; calyx 5-toothed; corolla 5-parted almost to the base; stamens 10, somewhat longer than the corolla and slightly exceeded by the slender style: ovary 3-celled: fr. a ribbed or winged, 1- to 2-seeded nut. Sometimes united with Halesia, from which it is distinguished chiefly by the panicled drooping inflorescence and the 5-merous fls.

hispida, Sieb. & Zucc. (*Halèsia hispida*, Mast.). Fig. 2014. Tree, attaining 25 ft., with slender spreading branches forming an open head: lvs. short-petioled, ovate to oblong, narrowed at the base, acute or acuminate, almost glabrous or pubescent on the veins beneath, light green above, grayish green beneath, 4–7 in. long: panicles 4–6 in. or more long: fls. creamy white, fragrant, about ¼ in. long: fr. 10-ribbed, thickly covered with bristly hairs, ¼ in. long. June. Japan. G.C. II. 22:177. Gn. 8, p. 243; 26, p. 23; 34, p. 111. R.H. 1875, p. 308. G.F. 5:389. M.D.G. 1899:353.

corymbòsa, Sieb. & Zucc. (*Halèsia corymbòsa*, Nichols.). Small tree, closely allied to the preceding: lvs. broader, oval or ovate, sparingly stellate-pubescent on both sides; panicle broader: fr. with 4–5 narrow wings, tomentulose. June. Japan.—Seems to be more tender than the preceding and is but rarely cultivated.

ALFRED REHDER.

PTERÓXYLON. See *Ptæroxylon.*

PTILÓMERIS is considered by Gray as a subgenus of Baeria. *P. coronaria*, Nutt., is the plant known to the trade as *Shortia Californica.* It is described and figured in this work under *Actinolepis.*

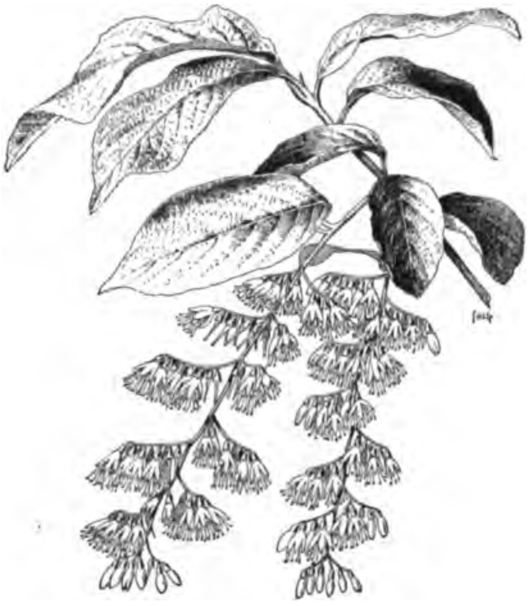
PTILÒTUS exaltàtus. See *Trichinium.*

PTYCHORÀPHIS (Greek, *folded* and *raphe*). *Palmàceæ.* A genus of 3 species of Malayan palms. Of *P. augusta*, Wm. Watson writes: "It is as graceful as *Cocos Weddeliana* or *Geonoma gracilis*, and it grows as freely under cultivation as either of these popular palms." This rare palm has been offered in America but is not known to be cultivated. The genus contains 3 species, one from Singapore, one from the Philippines and one from Nicobar.

The genus is placed next to Rhopaloblaste by Drude in Engler and Prantl's Natürlichen Pflanzenfamilien and distinguished by the ridge of the forked raphe and deeply ruminate seed, while the rumination of the upper parts of the seed is flattish.

augústa, Becc. Trunk becoming 80–100 ft. high, slender, smooth: lvs. becoming 8–12 ft. long; pinnæ 2–3 ft., linear, acuminate, bright green: fr. elliptical-oblong, red: seed grooved on one side. Nicobar.

F. W. BARCLAY.



2014. Pterostyrax hispida (× ⅓).

PTYCHOSPÉRMA (Greek words, probably referring to the ruminate albumen of the seed). *Palmàceæ.* The following names have appeared in American trade catalogues: *Ptychosperma Alexandræ, Cunninghamiana* and *Seemannii.* These are all referred below to other genera. For *P. elegans*, consult *Seaforthia.*

P. álba, Scheff. See Dictyosperma alba.—*P. Álexándræ*, F. Muell. See Archontophœnix Alexandræ.—*P. Cunninghamiàna*, H. Wendl. See Archontophœnix Cunninghamii.—*P. élegans*, Blume. Consult Seaforthia.—*P. Rúmphii.* Consult Drymophlæus.—*P. Seèmannii.* See Balaka.

PUCCOON. *Lithospermum.*

PUCCOON, RED. *Sanguinaria.*

PUCCOON, YELLOW. *Hydrastis.*

PUCHA-PAT. Name in India of *Patchouli.*

PUDDING BERRY. *Cornus Canadensis.*

PUERÀRIA (M. N. Puerari, botanist of Geneva). *Leguminòsæ.* Ten twining Asian herbs or shrubs, closely allied to Dolichos and Phaseolus, but differing among other things in the beardless style, tumid nodes of the racemes and monadelphous stamens. Lvs. 3-foliolate and stipellate, the lfts. sometimes lobed: fls. often large, pea-shaped, in long and dense, often compound, racemes; standard usually spurred at the base, about equaling the wings and keel: pod flattish, linear, many-seeded.

Thunbergiàna, Benth. (*Dòlichos Japónicus*, Hort. *Pachyrizus Thunbergiànus*, Sieb. & Zucc.). KUDZU VINE. Perennial with large tuberous starchy roots, making a most remarkably vigorous growth of slender, hairy, twining stems: lfts. rhombic-ovate to nearly orbicular-ovate, variously lobed, but the margins entire and ciliate: fls. pea-shaped, purple, in axillary spikes late in the season, not showy: pod large and flat. Japan and China. A.G. 13:387; 21; 505. G.F. 6:505. R.H. 1891, p. 31. Gt. 45:1429.—A hardy vine remarkable for the great rapidity of its growth, and most useful for covering arbors and verandas. From a well-established root, vines will grow 40–60 ft. in a single season, producing a profusion of very large lvs. In the North the plant dies to the ground in the winter, but in the South the top becomes woody. The large fleshy root assumes most curious shapes, the main branches often being 4–5 ft. long. Georgeson writes of the plant in Japan: "The roots are fleshy and yield starch of excellent quality; the tough fiber of the inner bark is manufactured into a sort of cloth which combines fineness with remarkable strength; and in certain situations the vine is unparalleled for ornament and shade." The fls. are borne on the old or woody stems, but these stems usually do not persist north of Philadelphia, and even rarely there. With age, the tops are more likely to survive the winter. Prop. by division of the roots, or by seeds when they can be had; also by cuttings. L. H. B.

PUFF-BALLS. See page 1045.

PULMONÀRIA (Latin, *lung;* the herb having been considered a remedy for diseases of the lungs). *Borraginàceæ.* LUNGWORT. About 6 species of mostly European perennial herbs, with creeping rootstocks and rather large, blue or purple fls. in terminal cymes. Calyx tubular-bell-shaped, 5-toothed or cleft to the middle only; corolla-tube straight, naked or pilose; limb 5-lobed; stamens included in corolla-tube: nuts smooth. Mertensia has a short, open, more deeply-cleft calyx, exserted stamens, and slightly fleshy nuts. Pulmonarias are of easy cultivation, preferring light soil, not very dry, in open or partially shaded positions. They are readily propagated by division. Divide the clumps every two or three years.

2015. Pulmonaria saccharata. (× 1/3.)

A. *Lvs. white-spotted.*

B. *Plant very glandular.*

saccharàta, Mill. BETHLEHEM SAGE. Fig. 2015. Height 6–18 in.: stem setose-hairy, with articulate glands: radical lvs. oval-acuminate at both ends, slightly decurrent, larger than in following species: fls. whitish or reddish violet. April, May. In shady places, Europe.

BB. *Plant rough-hairy but slightly if at all glandular.*

officinàlis, Linn. (*P. maculàta,* F. G. Dietr.). Height 6–12 in.: radical lvs. in distinct tufts, ovate-oblong to nearly linear, on long footstalks, coarsely hairy, more or less spotted: fls. in terminal forked cymes, red fading to violet. April. Woods, Europe.

AA. *Lvs. entirely green.*

angustifòlia, Linn. Height 6–12 in.: stem setose-hairy, having a few glands: radical lvs. elliptic-lanceolate to lanceolate, decurrent on petiole: fls. blue. April, May. Woods, Europe.

P. álba, Hort. Saul. is presumably Mertensia Sibirica, var. alba.—*P. Sibírica.* See Mertensia Sibirica.—*P. Virgínica.* See Mertensia pulmonarioides. F. W. BARCLAY.

PULSATÍLLA. See *Anemone.*

PULSE. See *Legumes.*

PULTENÆA is one of many genera of Australian shrubs of the legume family with clusters of yellow pea-shaped flowers. Pultenæas are practically unknown in American floriculture. Seventy-five species are distinguished in Flora Australiensis 2:107–140 (1864). For general purposes these plants are presumably inferior to *Cytisus Canariensis.*

PUMPKIN. See *Squash.*

PÙNICA (*Punicus,* Carthaginian: hence *Malum punicum,* "apple of Carthage," an early name of the Pomegranate). *Lythràceæ.* Genus of 1 species.

Granàtum, Linn. POMEGRANATE, which see. A large deciduous shrub or small tree, with mostly opposite or clustered oblong or obovate obtuse entire, glabrous and more or less shining lvs.: fls. axillary, solitary or in small clusters, orange-red, showy; calyx tubular, the short lobes 5–7 and persistent on the top of the fruit (as on an apple); petals equal in number to the calyx-lobes, inserted between the lobes, lanceolate to obovate, wrinkled: ovary imbedded in the calyx-tube (or receptacle-tube), comprising several locules or compartments in two series (one series above the other), ripening into a large, juicy, many-seeded pome-like berry., Persia to N. W. India.—A handsome plant, with showy fls. 1 in. across in summer. Hardy as far north as Washington and Baltimore. It is also grown as a conservatory plant, blooming in winter as well as in summer. For ornament, the double-flowering kinds are the most popular (F.S. 13:1385, as *P. Granatum Legrellei*). There are many named varieties. The treatment of the fruit-bearing varieties is discussed under *Pomegranate.*

Var. **nàna,** Hort. (*P. nàna,* Linn.). Dwarf Pomegranate, seldom growing higher than a man, and usually treated as a pot-plant in the North. It is the best kind for greenhouse use. The double-fld. form is most common. B.M. 634. It is as hardy as the species, and is suitable for outdoor work where the climate is not too severe. On the Pacific coast it is grown as a hedge plant as far north as San Francisco. Both this and the species are easily grown by cuttings of dormant wood, as currants are, but the cuttings should be started indoors with some heat. L. H. B.

PURIFICATION FLOWER. Same as snowdrop, *Galanthus nivalis.*

PURPLE CONE-FLOWER. *Echinacea.*

PURPLE WREATH. *Petrea.*

PÙRSHIA (after F. T. Pursh, or Pursch, as is the original spelling of his name (1774–1820); born at Grossenhain, in Saxony, not at Tobolsk, in Siberia, as is frequently stated; traveled in this country and wrote a flora of North America.) *Rosàceæ.* Low deciduous spreading shrub with alternate, mostly fascicled, small, cuneate and tridentate lvs., rather small, solitary, yellowish fls. and inconspicuous fruits. Of little ornamental value with its sparse grayish or bluish green foliage and its rather inconspicuous fls., and but rarely cultivated. Probably hardy as far north as Mass., requiring sunny position and well-drained peaty soil; an excess of moisture, especially during the winter, proves fatal to it. Prop. by seeds and probably by layers. But one species, native of western N. America and allied to Cercocarpus: petals 5; stamens numerous; pistils 1 or sometimes 2: fr. a pubescent leathery akene exceeding the persistent calyx.

tridentàta, DC. Diffusely branched shrub, attaining 5, rarely 10 ft.: lvs. cuneate-obovate, 3-lobed at the apex, whitish pubescent beneath, ¼–¾ in. long: fls. solitary on short branchlets, almost sessile, yellowish, about ¾ in. across: fr. ovate-oblong, acuminate. April–July. Ore. to Wyoming, New Mex. and Calif. B.R. 17:1446.—Var. **glandulòsa,** Jones (*P. glandulòsa,* Curran), is glandular and has very small, almost glabrous lvs., sometimes pinnately 5-lobed. ALFRED REHDER.

PURSLANE. *Portulaca oleracea.*

PURSLANE, WINTER. *Montia perfoliata.*

PUSCHKÌNIA (Count M. Puschkin, Russian poet). *Liliàceæ.* A genus of 2 species of hardy spring-blooming bulbs from S. Asia, with clusters of small 6-lobed white fls., each narrow lobe being prettily lined with blue. A good specimen may have as many as 10 fls., each ¾ in. across. The peculiar feature of the genus is the crown on which the stamens are borne. This is a white body of petal-like texture, having 6 lobes, each of which is variously toothed. The genus is allied to Scilla and Chionodoxa. Lvs. 2–3, linear, surrounding the lower part of the scape. Excellent early plants.

scilloìdes, Adams (*Addmsia scilloìdes*, Willd.). Height 4–12 in.: bulb globular, about ¾ in. thick: lvs. as long as scape, ½–1 in. wide: raceme 1–10-fld.; pedicels slender, erect: perianth usually bluish white; divisions elliptic-oblong, three times as long as the tube; crown one-third as long as divisions, cleft to middle into truncate or retuse teeth. Var. **Libanótica**, Boiss. (*P. Libanótica*, Zucc.), differs from the type in having divisions of perianth ½ in. long and the teeth of the crown more acute and bifid. Gn. 32, p. 5; 54, p. 219. B.M. 2244. F.S. 21:2220 (as *P. sicula*).

F. W. BARCLAY and W. M.

PUTRANJÌVA (meaning obscure). *Euphorbiàceæ.* A genus of 2 species of tender evergreen trees native of India. Lvs. alternate, undivided, entire or serrulate: fls. axillary, small, yellow or white, monœcious or diœcious, the female subsolitary, the male clustered; stamens 1–3: ovary 2–3-celled: drupe 1-celled. Flora of British India, 5:336.

Roxbúrghii, Wall. INDIAN AMULET PLANT. A moderate-sized tree, nearly glabrous: lvs. 2–3 in. long, obliquely ovate to ovate-lanceolate, serrulate: fls. small, yellow; sepals of male fl. 3–5, of female 5–6: fr. globose to ovoid, size of a cherry or smaller, white tomentose. Cult. in S. Fla.

F. W. BARCLAY.

PUTTY-ROOT. *Corallorhiza.*

PÙYA (Chilean name). *Bromeliàceæ.* Forty-four species, according to Mez (DC. Monogr. Phaner. 9) of large terrestrial xerophytic South American bromeliads, allied to Pitcairnia (differing in having a fully superior rather than partially superior ovary). For culture, see also Billbergia. *Puya cærulea, P. Whytei* and *P. heterophylla* are here referred to Pitcairnia. Puya also includes the plants known in trade as Pourretia.

A. *Fls. yellow.*

Chilénsis, Molina (*Pitcairnia coarctàta*, Pers., and *P. Chilénsis*, Lodd.). Becoming 4–5 ft. or more high, sometimes branching: lvs. in tufts, 2–4 ft. long, very narrow, often recurved, the margins armed with strong recurved spines or thorns, glaucous: blossoms in a branching, hoary, bracted inflorescence rising 3–5 ft. from the top of the caudex, the fls. large (2 in. across), sessile or nearly so, the 3 lanceolate sepals greenish and the obovate-oblong much-exserted petals yellow or greenish yellow, the 6 erect stamens shorter than the petals, the stigma 3-branched. Chile. B.M. 4715. F.S. 9:869–70. G.C. III. 7:685.—A striking and mammoth bromeliad, making a yucca-like mass of foliage and projecting above it a very showy inflorescence.

AA. *Fls. white or rose-color.*

gigas, André. Still larger than the latter, sending its titanic spikes 20 to 30 ft. into the air, from a rosette of hard and thick spiny-toothed agave-like lvs.: inflorescence simple, dense, club-shaped, terminating the tall, erect, bracted scape: lvs. green above and white beneath, the spines black and hooked: fls. white, passing into rose. Colombia, 10,000 ft. R.H. 1881, p. 315, and Gn. 21, p. 309.—Can probably be handled like agaves.

L. H. B.

Puyas and Pitcairnias are mostly warmhouse plants, requiring the general treatment given Musas, Dieffenbachias and Marantas. They prefer a fairly heavy loam, and, except when in bloom, a constant supply of moisture. When in bloom, the plant should be elevated on a pedestal or inverted pots in order to protect it from excessive moisture and to allow the scape full opportunity to expand. Propagated by division.

H. A. SIEBRECHT.

Puyas and Pitcairnias are generally found in collections of bromeliads and are usually grown in moist tropical houses. The native home of the Puyas is on the steep, stony slopes of the Cordilleras at high altitudes with little other vegetation for company except some species of Cereus. This would indicate that drier and cooler conditions, or such as we give Cacti and succulents, would suit them best, yet they thrive equally well in the tropical house. Indeed, the writer has found most of the family Bromeliaceæ very accommodating not only to temperature and moisture conditions, but to soils and methods of growing them; for instance, many of the Tillandsias may be grown on blocks of wood as epiphytes, yet they do equally well grown in pots. But what perhaps is more remarkable is the fact that several of the stronger-growing Bromeliads appear to grow equally well either in a strong loamy mixture, or a mixture of chopped fern root and charcoal. The writer has pineapples growing in both mixtures with equal success. But the most rational treatment is to give all the Bromeliads conditions and soil similar to the environment in which they are found in their native habitat, yet according to the experience of the writer few plants possess such remarkable adaptability to changed conditions as do these plants.

J. CANNING.

PYCNÁNTHEMUM (Greek, *dense* and *blossom*; referring to compact flower-heads). *Labiàtæ.* MOUNTAIN FRUIT. Hardy aromatic perennial herbs with branching stems and white or purplish fls. in terminal or sometimes also axillary clusters, borne in late summer. Calyx 2-lipped or 5-toothed, naked in the throat; corolla 2-lipped; stamens 4, straight and spreading, or connivent under the upper lip; the upper pair shorter or abortive: anthers 2-celled. The genus differs from Monarda in having smaller and canescent fl.-heads. Pycnanthemums are mint-like plants of easy culture in any good soil. The following grow 1–3 ft. high, and bear fl.-heads ½ in. across or less from July to September. Lvs. entire, glabrous or pubescent, nearly sessile.

A. *Lvs. lanceolate or linear-lanceolate: calyx-teeth ovate-triangular.*

lanceolàtum, Pursh. Stem rather stout: lvs. fragrant, firm, acuminate at apex, rounded or narrowed at base, 1–2 in. long, 2–5 lines wide. Dry fields, Canada to Ga., west to Minn. B.B. 3:112.

AA. *Lvs. linear: calyx-teeth subulate, bristle-tipped.*

linifòlium, Pursh. Stem slender: lvs. 1–2 in. long, ½–1½ lines wide. In fields, Mass. to Fla., Ont., Minn. and Texas. B.B. 3:111.

P. Monardélla, Michx., is properly Monarda Clinopodia, Linn. A perennial herb with a slender, usually simple stem 1–3 ft. high. Lvs. lanceolate to ovate, membranaceous, bright green, slender-petioled, 2–4 in. long: fl.-heads solitary, terminal: corolla yellowish, 1 in. long or less. June–Aug. Fields, Ont. to Ga. B.B. 3:102.—*P. vulgàre*, offered by Jacob W. Manning in 1892, was raised from seed received from Wm. Thompson, of Ipswich, Eng. J. Woodward Manning writes that this plant is properly Origanum vulgare, which see.

F. W. BARCLAY.

PYRACÁNTHA (Greek *pyr*, fire, and *akanthos*, thorn; alluding to the bright red fruits). *Rosàceæ.* Ornamental evergreen thorny shrubs, with alternate rather small and narrow crenulate lvs., white fls. in corymbs, and bright red fruits. *P. coccinea* is hardy as far north as Mass. in sheltered positions. It is a handsome low evergreen shrub, especially when loaded with its bright red fruits, these remaining on the branches all winter if not eaten by birds, which are fond of them; it is also pretty in spring with its numerous corymbs of white fls. It is well adapted for planting on rocky slopes or sunny rockeries or for borders of shrubberies; it may also be used for low ornamental hedges or for covering walls, as it stands pruning well and is easily trained into any desired shape. It thrives in almost any kind of well-drained soil, including limestone, and prefers sunny positions. Prop. by seeds or by cuttings of ripened wood in fall under glass, kept during the winter in a temperate greenhouse; also by layers and sometimes by grafting on Hawthorn or Cotoneaster. Pyracantha is a genus of 2 species from southeast Europe to the Himalayas; closely allied to Cotoneaster but easily distinguished by the crenulate lvs. and the thorny branches, also by the more conspicuous stipules. From Cratægus it is chiefly distinguished by the structure of the ovary, which contains 2 equal ovules in each cell, while in Cratægus each cell contains only one fertile ovule and a second imperfect and smaller one. Corymbs many-fld.; stamens about 20, with yellow anthers: fr. red or orange, rarely white, with 5 stones.

coccìnea, Roem. (*Cotoneáster Pyracántha*, Spach. *Cratæ̀gus Pyracántha*, Borkh. *Méspilus Pyracántha*, Linn.). Fig. 2016. Shrub, attaining 6 ft., rarely 20 ft., with numerous short spines: young branchlets and petioles grayish pubescent: lvs. oval-oblong to oblanceolate, acute, crenate, glabrous or slightly pubescent when young, ¾–1¾ in. long: corymbs pubescent, many-fld., about 1½ in. broad: fls. small, white: fr. numerous, bright red, about one-fifth in. across. May, June. Italy to W. Asia.—Var. **Lalándi,** Dipp. (*Cotoneáster crenulàta*, Hort., not Wenzig), is of more vigorous growth, with slender branches: lvs. less deeply crenate: corymbs larger: fr. bright orange-red. Well suited for covering walls and said to be hardier than the type. Var. **pauciflòra,** Dipp. Of low, dense habit and very thorny: corymbs small: fr. yellowish red. Hardy and well suited for hedges. Var. **frúctu álbo** is a form with white or yellowish fruits.

crenulàta, Roem. (*Cotoneáster crenulàta*, Wenzig. *Cratæ̀gus crenulàta*, Roxb.). Closely allied to the preceding: branchlets and petioles rusty-pubescent, glabrous at length: lvs. narrower, oblong to oblanceolate, obtuse or acutish, more leathery, bright green and glossy above, 1–2 in. long: corymbs glabrous: fr. globose, bright orange-red. May, June. Himal. B.R. 30:52.—More tender than the preceding, with handsomer, glossier foliage.

ALFRED REHDER.

2016. Pyracantha coccinea (× ⅓).

PYRÈTHRUM in garden literature and language nearly always means *Pyrethrum roseum*, the handsome summer-blooming hardy perennial composite, with finely dissected foliage, pictured on page 312 of this work, Fig. 463. It is a favorite border plant in Europe, but little known in America, although it has several hundred varieties. It requires special culture, for which see p. 310. Nearly all the Pyrethrums with personal names, as Ajax, Ceres, etc., are forms of this species. These varieties are also listed in catalogues as hybrid Pyrethrums or *P. hybridum*. Although the genus Pyrethrum was long ago reduced to the rank of a mere section of Chrysanthemum, the name Pyrethrum is still prominent in our nursery catalogues, and it has become thoroughly established in the English language as the common or popular name of *Pyrethrum roseum* and its varieties, which are now referred by botanists to *Chrysanthemum coccineum*.

In Engler and Prantl's Natürlichen Pflanzenfamilien, Hoffmann makes eight sections of Chrysanthemum. Among these the section Pyrethrum is distinguished, chiefly, though not entirely, by the fact that the plants are perennial and by the 5–10-ribbed akene. In this section Hoffmann places the florists' chrysanthemums (generally said to be the product of *C. Indicum* × *Sinense*); also *Pyrethrum roseum;* also the white weed or oxeye daisy, *C. Leucanthemum;* the costmary, *C. Balsamita*, var. *tanacetoides;* and *C. cinerariæfolium* and *corymbosum*. Here also belong the Golden Feather, Figs. 2017, 459, the well-known bedding plant with golden foliage, and *C. uliginosum*, which has attracted considerable notice within recent years.

W. M.

2017. Golden Feather.

A common bedding plant with yellow foliage, often catalogued as *Pyrethrum parthenifolium*, var. *aureum*. See p. 311, species No. 4.

PÝROLA (name said to be derived from Pyrus, name of the pear tree). *Ericàceæ*. WINTERGREEN. SHINLEAF. Perennial evergreen, stemless herbs, with a cluster of orbicular or elliptical leaves attached to the top of the branching, slender, underground rootstocks: scape angular and scaly-bracted, bearing racemes of white, greenish or purple, nodding fls. in summer. Fls. slightly irregular; sepals 5, imbricated; petals 5; stamens 10; style declined or straight: capsule 5-lobed, splitting from below upwards, bearing numerous small seeds. The genus has about a dozen species and several varieties, found in the north temperate zone from Great Britain to Asia and North America south to Mexico. About 10 species occur in North America. They grow naturally in rather poor sandy uplands and in bogs. Like many other members of the heath family, Wintergreens are difficult to cultivate and will not succeed in garden soil. In removing them from the woods, care should be taken to secure a large ball of earth. They may then succeed in the shade of evergreens and upon rockeries in peaty soil. The species are scarcely in general cult.; they are offered by dealers in native plants. *P. rotundifolia* is probably more cult. than the others. For a fuller botanical account, see Gray's Syn. Flora N. Amer.

A. *Fls. greenish; style straight.*

secúnda, Linn. Height about 6 in.: lvs. thin, ovate, crenate, 1–1½ in. long: fls. small, in a one-sided, dense, spike-like raceme. North Atlantic states to Lab., Rocky Mts. to arctic regions, N. Europe to Japan.

AA. *Fls. greenish white; style curved downward.*

chlorántha, Swartz. Height 5–10 in.: lvs. small, orbicular, dull, shorter than the petiole: fls. few; anther cells with beaked tips. Lab. to Pa., Rocky Mts., north to subarctic regions.

ellíptica, Nutt. Height 8–10 in.: lvs. broadly oval or oblong, thin, dull, serrulate, 2–2½ in. long, longer than the petiole; loosely 5–10-fld. Canada to Brit. Col. and through N. Atlantic states to New Mex., Japan.

pícta, Smith. Height 5–10 in.: lvs. thick, broadly ovate to spatulate, blotched with white above, dull, longer than the petioles. Pacific slope.

AAA. *Fls. white to pink or purple.*

rotundifòlia, Linn. Height 5–12 in.: lvs. orbicular, about 2 in. long, thick, shining above, shorter than the petioles: fls. numerous: bracts conspicuous. Var. uli-

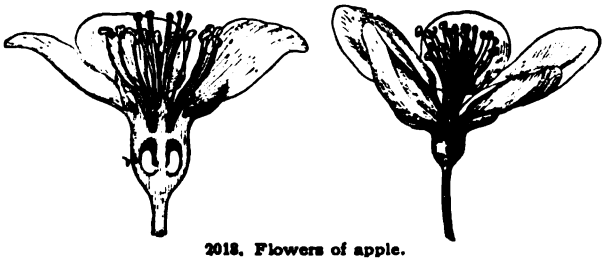
ginòsa, Gray, with pink or rose-colored fls. and subcordate to obovate, dull lvs., occurs in swamps, Arctic regions, and as far south as Ga., New Mex. and Calif. Var. **asarifòlia,** Hook., with purple fls. and round kidney-shaped to ovate-orbicular lvs., occurs northward.

C. F. Wheeler.

PYROLA, One-flowered. *Moneses grandiflora.*

PỲRUS (Latin name of pear tree). Sometimes spelled *Pirus*. *Rosàceæ*. Pome Fruits. Flowers normally perfect, regular, in spring; torus urn-shaped and attached to the carpels and finally closing over them, and with them becoming fleshy in fruit; calyx-lobes 5 and persistent upon the top of the young fruit, or in some cases falling away at partial maturity; petals 5, white or red; stamens 20 or more; pistils 2 to 5, crowning a 2- to 5-loculed ovary in which the locules are usually 2-seeded. Fig. 2018. Pyrus is a polymorphous genus, comprising some 30 to 50 species in the northern hemisphere. Trees or shrubs, with alternate leaves which are simple in the common species but compound in *P. heterophylla* and rarely in some of the apple tribe. The species are cultivated for their edible fruits and for ornament. Apples and Pears are the leading species. The species are mostly small trees, bearing clusters of showy white or blush flowers with the leaves or in advance of them. They are natives of the northern hemisphere, mostly of cool temperate parts, and the greater part of them are hardy in the northern states. They are of easy culture. The pear-like species may be worked on Pear stocks, and the apple-like species on Apple stocks.

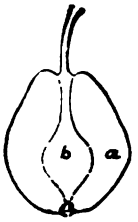
The fruit of Pyrus is of the kind known to botanists as a pome. The morphology of the pome is still a subject of dispute, although most botanists now agree in considering it to be a hollow torus (receptacle) in which the ovary is imbedded. Fig. 2019 illustrates the theoretical structure. The ovary is at *b*, wholly inclosed in the fleshy torus *a*. Most of the edible part of the Apple or Pear, therefore, is considered to be torus, whereas the core is ovary. This ovary is of five carpels or cells, as shown in the cross-section, Fig. 2020. It was formerly held that the edible part is largely calyx-tube, but various morphological considerations have inclined students to regard it as stem rather than calyx. One of these reasons is the fact that Apples sometimes bear a rudimentary leaf (as in Fig. 2021), an organ which is commonly borne only by stems.



2018. Flowers of apple.

The ovaries are shown in the section, an ovule being at O.

There are the widest differences of opinion as to the generic limits of this group of plants. What is regarded by Bentham & Hooker as one genus is regarded by others as 10 or 12 genera (see, for example, E. Koehne, "Die Gattung der Pomaceen," Wissensch. Beil. zum Program des Falk-Realgymnasiums, Berlin, 1890). In the present work, some of these species (the quinces) are set off as *Cydonia*, the medlar as *Mespilus*, and the mountain ashes, chokeberries and their kin as *Sorbus*. This restricts Pyrus to the pear-like and apple-like species.

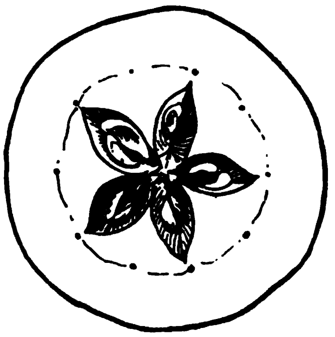


2019. Diagram of a pome (pear).

Showing the torus part at *a* and the ovary part at *b*.

1. Pears.—(*Pyrophorum*). Fruit either with a conical base or possessing a cavity like an apple, the flesh bearing grit cells; styles usually free or not united at the base. (Nos. 1–5.)

Of these plants there are perhaps 15 to 20 species, natives to south-central Europe and Asia, with the greatest expansion in the Grecian-Asia-Minor-Syrian region. Of this particular region, Bossier (Flora Orientalis) reduces the species to eight, *P. communis*, *P. cordata*, *P. amygdaliformis*, *P. elæagrifolia*, *P. salicifolia*, *P. Syriaca*, *P. Boveana*, *P. glabra*. Some of these have fruits of comestible value, and it is not impossible that they may be worthy of amelioration. The best horticultural account of the species of Pears, with particular reference to their pomological values, will be found in vol. 1 of Decaisne's "Le Jardin Fruitier du Museum," where superb plates are given.

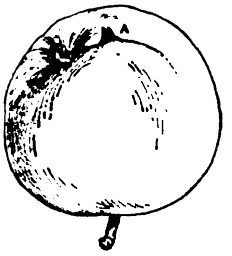


2020. Section of a pome (apple).

Showing the interior or ovary part and the exterior or torus part.

2. Apples (*Malus*).—Fruit with a sunken base or "cavity," the flesh without grit cells; styles more or less united below (Nos. 6–19).

There are probably 20 good species of this subgenus, of wide distribution. The common Apple, *P. Malus*, is probably indigenous in southwestern Asia. In Siberia, China and Japan, several species are native, of which the best known are the smooth-growing Crab trees with small fruits that shed their calices. In North America is another set, represented by the Garland Crab, *P. coronaria* of the East, the Narrow-leaved Crab, *P. angustifolia* of the Southeast, the Prairie States Crab, *P. Ioensis*, and the far western Crab, *P. fusca*. It is difficult to find good characters to separate the small-fruited Apples, particularly the Asiatic forms. Carrière attempted to solve the difficulty (*Pommiers microcarpes*, Paris, 1883) by referring them all to one polymorphous species-group, *Malus microcarpa*. Although Pyrus and Malus are very closely related botanically, they hold their distinctions with much persistency and they do not interhybridize. Many writers prefer to keep the genera distinct, but the characters of separation are too minute and technical for ordinary diagnostic purposes. It does not follow that characters have generic value merely because they are constant. The marks that separate Malus from Pyrus are not readily determinable on the herbarium sheet, and are therefore of relatively little value to the systematist, for whom generic lines are chiefly erected. Their distinctness is further shown by their relations to inter-grafting, although the graftage-relation is not coincident with the classification-relation. It is usually impossible to graft the pear-species on the apple-species with any degree of success; yet pears thrive on quinces and also on hawthorns, which are well marked genera.



2021. A pome bearing a rudimentary leaf (at A).

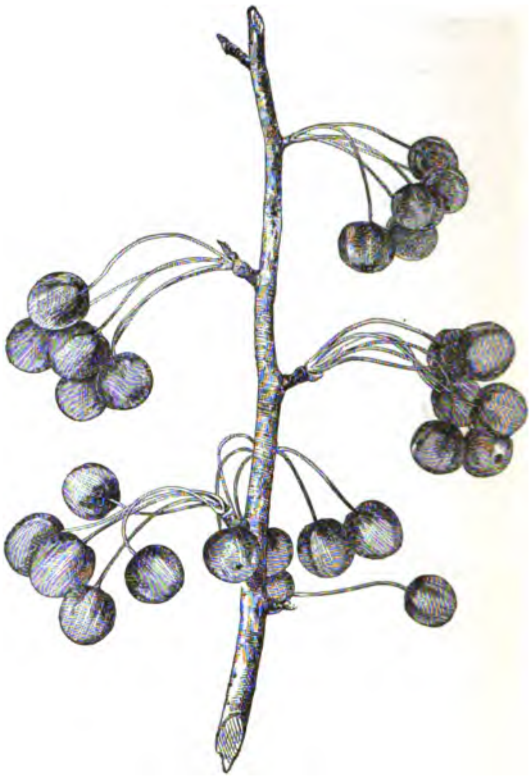
INDEX.

acerba, 10.
Achras, 1.
Americana. See *Sorbus*.
amygdaliformis, 5.
angustifolia, 16.
arbutifolia. See *Sorbus*.
Aria. See *Sorbus*.
Astracanica, 10.
Aucuparia. See *Sorbus*.
auricularis, 5.
baccata, 9.
betulifolia, 5.
Bollwylleriana, 5.
cerasifera, 9.
Cathayensis. See *Cydonia*.
communis, 1.
coronaria, 15.
cratægifolia, 19.
Cydonia. See *Cydonia*.
dioica, 10.
domestica. See *Sorbus*.
elæagrifolia, 5.
floribunda, 7.
fusca, 14.
Germanica. See *Mespilus*.
Halliana, 8.
heterophylla, 1, 5.
hybrida. See *Sorbus*.
Ioensis, 17.
Japonica, 3. See also *Cydonia*.
Kaido, 13.
Kotschyana, 5.
Malus, 10.
Maulei. See *Cydonia*.
Miyabei. See *Sorbus*.
Michauxii, 5.
nigra. See *Sorbus*.
nivalis, 2.
Paradisiaca, 10.
Parkmani, 8.
Pollveria, 5.
prunifolia, 9.
Pyraster, 1.
Ringo, 12.
rivularis, 14.
Riversii, 11.
salicifolia, 4.
sambucifolia. See *Sorbus*.
Scheideckeri, 7.
sempervirens, 16.
Sieboldii, 3, 6.
Sikkimensis, 19.
Simonii, 3.
Sinaica, 5.
Sinensis, 3, 11.
Soulardi, 18.
spectabilis, 11.
Toringo, 6.
torminalis. See *Sorbus*.
Tschonoskii, 5.
Ussuriensis, 3.

A. PYROPHORUM OR PYRUS PROPER: *fr. with granular or gritty flesh (unless ripened off the tree); styles usually free to the base.*

1. **commùnis**, Linn. COMMON PEAR. Figs. 1684–89, 2022. Strong, upright tree, living to a great age and sometimes attaining a height of 75 ft., the pedicels and sometimes the young growth pubescent, but all parts becoming glabrous: lvs. mostly oblong-ovate, with a prominent point, hard in texture and veiny, bright green, the serratures small and much appressed and obtuse, or sometimes the leaf is almost entire: fls. in umbel-like clusters on slender (2 to 3 in.) pedicels, white, appearing with the lvs.; calyx persistent: fr. very various under cultivation, usually tapering to the stem, the flesh generally with gritty concretions. Native to southern Europe and Asia, where it has been cultivated from the earliest times.—Probably indigenous as far east as Kashmir. In the Syrio-Persian region are several very distinct Pyruses of the Pear group, a number of which may be outlying forms of *P. communis*. In the wild in Europe, various thorny and small-fruited forms are known, two of which are often separated under Latin names: Var. **Àchras**, Wallr., with ovate-acuminate long-stalked lvs. which, with the calyx-tube, are tomentose when young, and the fr. tapering at the base. Var. **Pỳraster**, Wallr., with roundish acute, strongly serrate lvs., which, with the calyx-tube, are glabrous when young, the fruit rounded at the base. There are forms of *P. communis* with variegated foliage (var. *variegata*), lobed (var. *trilobata*) and cut leaves (var. *heterophylla*).

2022. Pyrus communis (× ½).


2023. Pyrus Toringo (× ½). See No. 6.

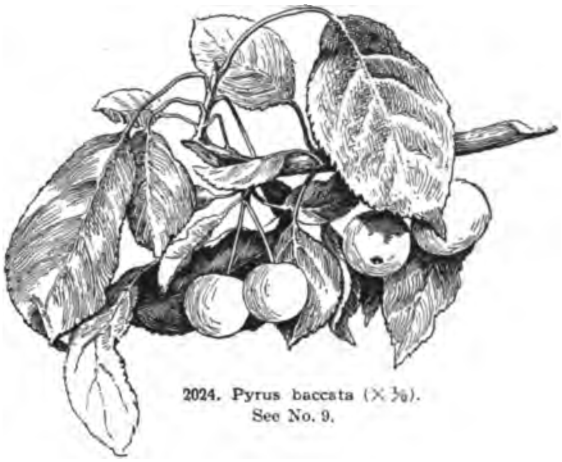
2. **nivàlis**, Jacq. SNOW PEAR. Shoots grayish pubescent: lvs. oval to obovate-oval, obtuse or short-acute, entire, gray-pubescent: fls. large, white, showy: fr. small, roundish pyriform, late-ripening, acid, becoming sweet when overripe. Southern France, southern Germany, northern Italy, Austria.—The Snow Pear is a small tree, with thick shoots that are white- or gray-hairy when young. It is grown in parts of Europe, particularly in France, for the making of perry or Pear cider, the greater part of such varieties being of this species. By some writers it is considered to be a form of *P. communis*. It is not known to be in cultivation in this country, but it would not be strange if some of the imported Pear stocks were of this species. Said to be called Snow Pear because the fruits are fit for eating after snow falls. This is the *Poire Sauger* ("sage-leaved Pear") of the French.

3. **Sinénsis**, Lindl. (*P. commùnis*, var. *Sinénsis*, Koch. *P. Ussuriénsis*, Maxim. *P. Simònii*, Carr. *P. Sièboldii*, Carr. *P. Japónica*, Hort.). SAND PEAR. JAPANESE and CHINESE PEAR. Fig. 1680. A very rapid-growing tree, with strong, thick shoots: lvs. broadly ovate and long-pointed, very dark green, the margins thickly furnished with very sharp, sometimes almost bristle-like teeth: fls. large, appearing rather in advance of the foliage: fr. hard and usually roughish, commonly with a depression or "cavity" about the stem, the flesh tough and gritty and poor in flavor, the calyx usually falling before maturity. Native to China. B.R. 15:1248. R.H. 1872, p. 28; 1880:110. G.C. III. 28:298.—Known in this country in a number of varieties, as Chinese Sand, Japanese Sand, Hawaii, Madame von Siebold, Mikado, Diamyo, Gold Dust. The fruits are often remarkably apple-like, especially in the russet varieties, but they are distinguished by the long stem and pear-like flesh.

It is little prized for its fruit, although the pears are useful for preserving and some of the varieties are showy and the fruits are good keepers; it is used for stocks upon which to work the common Pear, and it has given good results in hybridizing. It is an excellent ornamental tree, being a clean grower of great vigor. Kieffer, Le Conte and others are hybrids of *P. communis* and *P. Sinensis* (Figs. 1681–3). This type has a stronger growth than the common Pears, the leaves are usually broader and darker green, with closely and mostly obtusely serrate edges, the fruit is more or less pyriform and of better flavor than that of *P. Sinensis*, and the calyx is either persistent or deciduous. Seedlings of Kieffer often produce the sharply toothed leaves of *P. Sinensis*.

4. **salicifòlia**, Pall. Small tree, becoming 20 ft. tall: lvs. willow-like (whence the name), linear-lanceolate or lanceolate, obtuse or short-acuminate, entire or very nearly so, hoary beneath: fls. white, in corymbs, short-pedicelled: fr. round-pyriform, short-stemmed, yellow or greenish. Siberia. G.C. II. 14:145.—A showy spring-flowering small tree, hardy in the northern states, and worthy of being better known.

5. The following species of the section Pyrophorum (Pears) may be expected to appear in the trade, and some of them are now growing in private collections in this country. *P. auriculàris*, Knoop (P. Pollveria, Linn. P. Bollwylleriana, DC.). Differs from the Pear in having softer more irregular lvs., which are deeply serrate and sometimes almost jagged, pubescent beneath at maturity: fr. small (¾–1½ in. long), pyriform, orange-red, hard and usually austere. Long ago discovered in cultivation in France. Regarded as a hybrid, probably of P. communis and P. Aria (see Sorbus). Commonly planted in European collections. B.R. 17:1437. L.B.C. 11:1009.—*P. amygdalifórmis*, Vill. Much like P. nivalis, but the lvs. broad-elliptic or lance-elliptic and at maturity nearly or quite glabrous beneath: fls. white: fr. small and green, hard, top-shaped. S.E. Eu. and Asia. B. R. 18:1484 (as P. nivalis).—*P. betulifòlia*, Bunge. Tree, to 20 ft.: lvs. ovate-acuminate, long-stalked, sharp-serrate, becoming shining green above, pale tomentose beneath: fls. white, ⅔ in. across: fr. nearly globular, size of a pea, brown and dotted, the calyx falling. N. China. Hardy in N. England. R.H. 1879, pp. 318, 319. G.F. 7:225. A.F. 13:1396. Gng. 6:309. A worthy plant for ornament, bearing a profusion of fls. in advance of the lvs.—*P. Bollwylleriàna*, DC. See P. auricularis, above.—*P. elæagrifòlia*, Pall. Small spiny tree, the young shoots tomentose: lvs. lanceolate to oblong-lanceolate, short-acuminate, entire, usually silky-tomentose: fls. small, on densely tomentose pedicels: fr. globose-turbinate, glabrous, the calyx persistent. Caucasus, S. Russia. Var. Kotschyana, Boiss. (P. Kotschyana, Boiss.), is usually spineless, the foliage larger (3 in. long), the fr. larger (about 1 in. in diam.) and globose. The specific name was first written, by Pallas, elæagrifolia (not elæagnifolia), because he considered elæagrus to be the proper spelling of the name of the oleaster genus, it having been spelled that way by Dioscorides.—*P. heterophýlla*, Regel & Schmalh. Small tree, with very variable foliage, some plants "having lvs. that are smooth at the margin: others are slit and almost of thread-like form; but the majority exhibit forms intermediate between these two extremes." Lvs. usually ovate in outline, but mostly pinnatifid and the segments again toothed. E. Turkestan. G.C. III. 7:115.—*P. Michauxii*, Bosc, is referred to P. amygdaliformis, by Boissier.—*P. Pollvèria*, Linn.=P. auricularis, above.—*P. Sinàica*, Thouin, is referred to P. amygdaliformis by Boissier.—*P. Tschonóskii*, Maxim. Tree, 30–40 ft.: lvs. ovate acuminate, coarsely serrate, with sharp teeth, shining and pilose above, somewhat tomentose beneath: fr. obovoid; calyx-lobes persistent, white-tomentose, 1 in. or less in diam., yellow with a rosy cheek. Japan. G.F. 7:55. Sargent, Forest Fl. Japan 14.



2024. Pyrus baccata (× ⅓). See No. 9.

AA. MALUS, THE APPLES: *fr. usually without grit-cells; styles usually united at the base.*

B. *Oriental (Old World) species: lvs. mostly finely and evenly serrate and not lobed except on strong shoots: calyx either persistent on the fr. or caducous.*

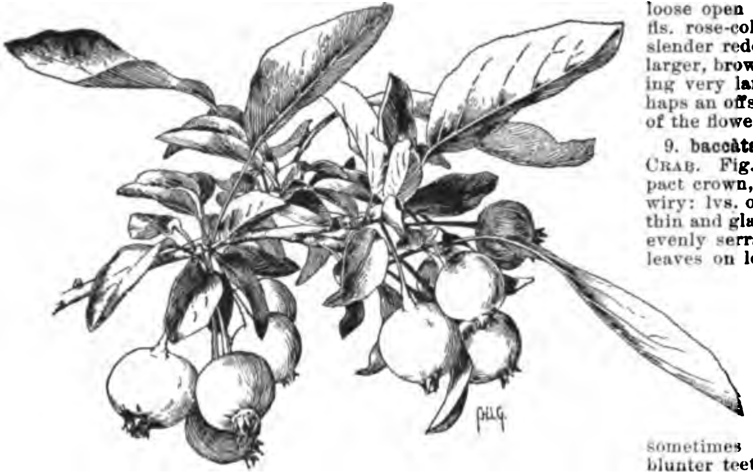
C. *Calyx deciduous, leaving the apex of the fr. naked.* (Figs. 2023, 2024.)

D. *Lvs. on summer shoots more or less lobed.*

6. **Toringo**, Sieb. (*P. Sièboldii*, Regel, not Carr.). TORINGO or DWARF CRAB. Fig. 2023. Shrub or dwarf tree, nearly glabrous: lvs. ovate or oblong-ovate in outline, bright dark green above and thinly pubescent below, becoming colored in the fall, strongly notched or lobed on either side at or below the middle, the middle lobe often notched again near the top, the remaining margins sharply dentate: fls. small, white or blush, on slender stems: fr. the size of a pea, shedding its calyx. Japan. R.H. 1870:451; 1881, p. 296. Gn. 34, p. 206. M.D.G. 1899:456. Carrière, "Pommiers Microcarpes," pp. 43, 62.—Grown mostly for ornament, but lately recommended as a hardy stock upon which to dwarf the Apple. In Japan, the little fruits are gathered after frost and preserved. Upon the fruit-spurs, the leaves are sometimes only toothed, but upon barren or strong

2025. Pyrus Malus, the apple.

shoots they are prominently lobed and suggest the leaves of hawthorns. Closely allied to *P. baccata,* and to *P. floribunda* of the gardens. Sargent writes (Forest Flora of Japan, p. 40) that *P. Toringo* "is a common and widely distributed plant in Japan, growing from the sea-level in Yeddo to elevations of several thousand feet in central Hondo, usually in moist ground in the neighborhood of streams." It varies from a low bush to a tree 30 ft. high. The leaves are exceedingly variable.



2026. Pyrus spectabilis (× ½). No. 11.

DD. *Lvs. on summer shoots not lobed.*

E. *Vernation (lvs. in bud) conduplicate.*

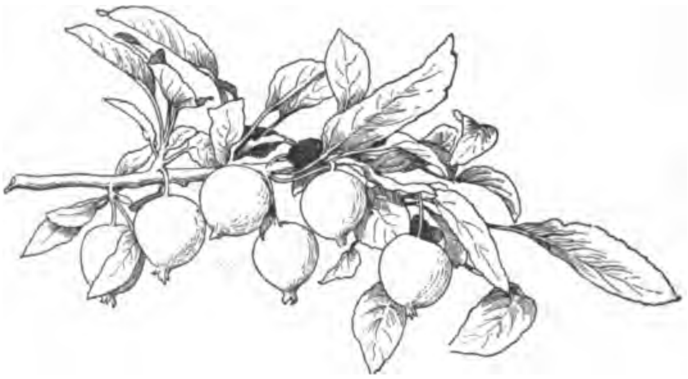
7. **floribúnda,** Nichols. (*P. Màlus floribúnda,* Hort. *Màlus floribúnda,* Sieb. *M. microcárpa floribúnda,* Carr.). Flowering Crab. Shrub or sometimes a small tree, often thorny: young growths glabrous or very soon becoming so: lvs. ovate and usually acuminate, the petioles rather thick and reddish and usually not much if any more than 1 in. long on the leading young shoots, the margins finely but very sharply serrate, usually thickish, shining above and glabrous (or soon becoming so) beneath: fls. rose or rose-red, appearing with the lvs., produced in great abundance and very showy: fr. usually about the size of a pea, on long, slender stalks, red, not persisting till winter. Japan. R.H. 1866:311; 1871:591; 1881, p. 296. F.S. 15:1585. G.F. 1:152; 2:523. A.G. 13:437; 18:437. F.E. 9:573. Gt. 47:1448 (var. *atrosanguinea*). M.D.G. 1899:454. Carrière, "Pommiers Microcarpes," pp. 44, 65. —One of the best of all early spring-flowering bushes or small trees, and now common in gardens. The semi-double forms often receive the names *Halliana* and *Parkmani.* A recent double-fld. form is var. *Scheideckeri* (Gng. 6:308. A.F. 13:1398). There is much doubt as to the proper specific disposition of this plant.

EE. *Vernation convolute.*

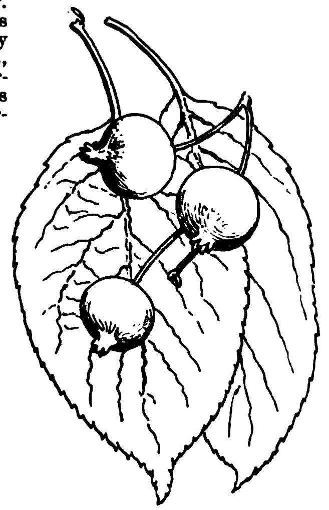
8. **Halliàna,** Voss (*P. Pàrkmani,* Hort. *Màlus Halliàna,* Kœhne). Bush or small tree, 6–15 ft. tall, with a loose open crown: lvs. long-ovate, glabrous, leathery: fls. rose-colored, usually half-double and hanging on slender reddish pedicels: fr. size of a pea or somewhat larger, brownish red, ripening late in fall and containing very large seeds. Japan. M.D.G. 1899:457.—Perhaps an offshoot of *P. baccata.* One of the handsomest of the flowering Apples.

9. **baccàta,** Linn. (*Màlus baccàta,* Desf.). Siberian Crab. Fig. 2024. Small spreading tree, with a compact crown, smooth in all its parts; growth hard and wiry: lvs. ovate to ovate-lanceolate or ovate-acuminate, thin and glabrous, on slender petioles, finely and nearly evenly serrate, bright green: fls. appearing with the leaves on long and very slender (2 to 3 in.) greenish pedicels, typically pure white, handsome: fr. from the size of a pea to ¾ in. in diameter, on long, hard stems, yellow or red and firm and often translucent in texture, never becoming mellow, the calyx falling away before maturity. Siberia to Manchuria and the Himalaya region. B.M. 6112. M.D.G. 1899:454.—Difficult to distinguish from *P. floribunda:* larger, becoming a distinct tree, sometimes as large as a large Apple tree: lvs. with blunter teeth, and usually much longer, very slender, hard, glabrous petioles: fls. lighter colored, usually white; vernation convolute (lvs. rolled in the bud). It runs into many forms, particularly in fruit.

The term Crab Apple has an indefinite application. In general, it is applied in this country to any small, hard sour Apple, particularly to such as cannot be used for dessert. All the indigenous Apples are called Crabs, and sometimes seedlings of the common Apple are similarly designated, as in the term "Crab-stocks," which is used for imported seedling stocks. As applied to orchard fruits, it comprises, as a rule, those small hard-fleshed varieties of Apples like the Transcendent and Hyslop, and these plants are further distinguished by smoothish parts, hard twigs, and long petioles and fruit-stems. These types of Crabs are no doubt hybrids between *Pyrus Malus* and *P. baccata.* They are often referred to *Pyrus prunifolia* (Willdenow Phytogr. i. 8 (1794). See B.M. 6158), which is apparently a derivative of *P. Malus* and *P. baccata,* through hybridization. The writer reaches this conclusion after having examined Willdenow's original specimen, yet preserved at Berlin. The fruit of *P. prunifolia* partakes much of the brittle and translucent texture of *P. baccata,* but it is larger, commonly more farinaceous, and the calyx is persistent. Some Crabs that pass as Siber-

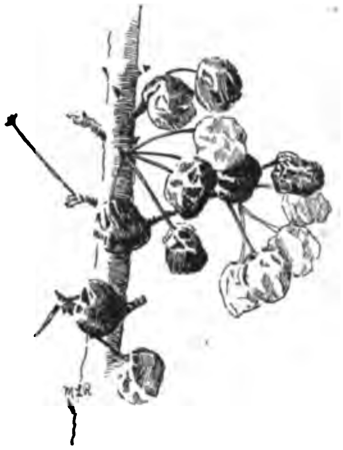


2027. Pyrus Ringo (× ½). Leaves rather narrow. No. 12.

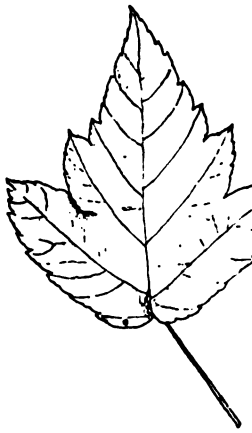


2028. Pyrus Ringo (× ½).

2029. Pyrus Kaido of American horticulturists (× ⅓).



2030. Fruit of Pyrus Kaido in winter. (× ⅓.)



2031. Pyrus coronaria (× ½).

ian belong to this mongrel class. Some of the so-called Crabs are only small-fruited forms of *Pyrus Malus*, being distinguished by soft woolly leaves and short pubescent leaf-stalks and fruit-stems. Some writers consider *P. prunifolia* to be a good species. By some, the hybrids of *P. Malus* and *P. baccata* are referred to *P. cerasifera*, Tausch.

cc. *Calyx persistent on the ripe fruit.*

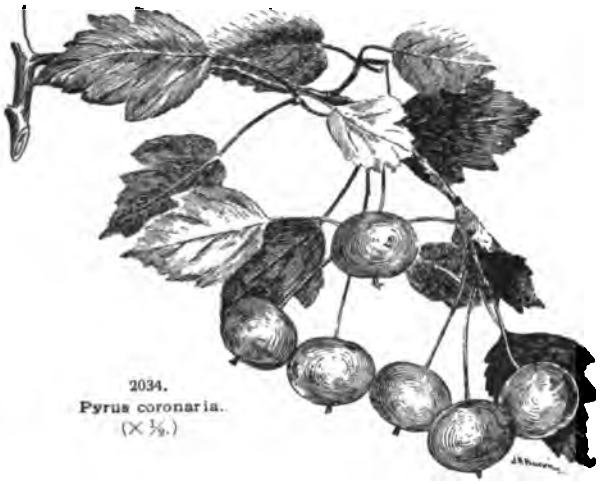
10. **Màlus**, Linn. (*P. Astracánica* and *P. acérba*, DC. *Màlus communis*, DC. *Màlus Màlus*, Britt.). APPLE. Figs. 107–112, 2025. A round-headed tree, with all the growing parts and under surface of the leaves gray-woolly: lvs. ovate or orbicular-ovate, mostly pointed, soft in texture, dull, the margins irregularly serrate, on stout petioles: fls. large and showy, white or light rose, in close clusters on short woolly pedicels, appearing with the leaves: fr. very various, with a cavity about the stem, a homogeneous flesh and persistent calyx.—Cultivated from remote antiquity, and believed to be native to southeastern Europe and western temperate Asia to the Himalayas. "Indigenous in the western hills [of the Himalaya], as well as cultivated up to 11,500 feet in Tibet," Hooker. It varies into many forms, and several species have been erected upon the different types. The Paradise Apple (*P. Malus*, var. *paradisiaca*, Linn.) is a dwarf form known in this country chiefly as a stock upon which to graft Apples that it is desired to dwarf. The Bloomless Apple (*P. dioica*, Willd.) is an apetalous form, with ten to fifteen styles, 2 rows of sepals, a superimposed core and no stamens; see Amer. Gard. 10, p. 244, 279; 11, p. 6 (figs.), 624. There are ornamental forms, with variegated lvs. (Gt. 45:1425, var. *aurea*), others with partially double fls., others with drooping habit.

11. **spectábilis**, Ait. (*P. Màlus spectábilis*, Hort. *Màlus spectábilis*, Borkh. *M. Sinénsis*, Dum.). CHINESE FLOWERING APPLE. Fig. 2026. Small tree, with darker colored fls. than those of the Apple (the opening fl.-buds almost coral-red), and blooming earlier: lvs. narrower, oval to oval-oblong, slender-stalked, nearly glabrous on both surfaces or becoming so, usually more closely serrate than those of the Apple: pedicels and calyx-tube nearly or quite glabrous: fr. roundish or round-oval, without a cavity at the base, reddish yellow, sour. China, and perhaps Japan. B.M. 267. L.B.C. 18:1729. Gn. 21, p. 46. Gng. 3:273. G.F. 1:272.—A very handsome early-blooming tree, of which the double-fld. forms are most prized. *P. Malus* itself has been disseminated under the name of *P. spectabilis*. Hardy in the northern states. Var. **Riversii**, Hort., has very large half-double bright rose-red flowers.

12. **Ringo**, Wenzig (*P. spectábilis*, var. *Ringo*, Koch. *P. Toringo*, var. *Ringo*, Nichols. *Màlus Ringo*, Sieb.). Figs. 2027, 2028. Spreading bush or small tree, all parts more pubescent than in *P. spectabilis*: lvs. usually broader, broad-oval to round-oval, sharply serrate, relatively short-stalked: fls. large, rose-colored, in few-fld. clusters: fr. small, somewhat depressed at the base about the stem, about ¾ in. in diam. Japan. Carrière, "Pom. Microcarpes," p. 41, as *P. microcarpa Ringo*.—Very doubtful whether a distinct species.

13. **Kàido**, Sieb. (*P. spectábilis*, var. *Kàido*, Nichols. *Màlus Kàido*, Sieb.). Figs. 2029, 2030. By some thought to be a hybrid of *P. spectabilis* and *P. Ringo*, and by others considered as a good species. It is not certain that the *P. Kaido* originally meant by Siebold is the *P. Kaido* of American horticulturists. As known here, it is very like *P. spectabilis*, bearing most profusely of red fls., with red pedicels and calyx, and holding its little fruits all winter: fr. nearly globular, ⅓–¾ in. in diam., mostly holding the calyx but sometimes dropping it in midsummer,—the dropping of the calyx, as well as the habit of growth, suggesting hybridity with *P. floribunda*. It comes from Japan. It is a most useful plant, being one of the most showy of all the oriental flowering apples.

2032. Wild Crab of the East, Pyrus coronaria (× ⅔). **No. 15.**

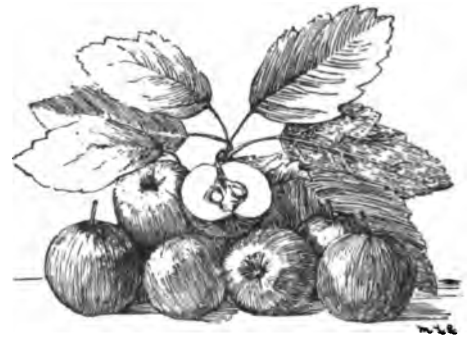


2034. Pyrus coronaria. (× ⅓.)

BB. *American native species: lvs. for the most part coarsely toothed and more or less lobed or notched: calyx persistent (exception in P. fusca).*

C. *Calyx deciduous from the fruit.*

14. **fùsca**, Raf. (*P. rivulàris*, Dougl.). Shrub or small tree, sometimes 30–40 ft. tall, the young growths more or less pubescent: lvs. ovate-lanceolate, acute or acuminate, very sharply and strongly serrate, often 3-lobed or notched on the strong shoots, pubescent beneath: fls. white, on slender pubescent pedicels, appearing when the lvs. are nearly or quite full grown, nearly or fully 1 in. across: fr. oblong, ¾ in. or less long, yellow or greenish, the calyx-lobes caducous. N. Calif. to Alaska. S.S. 4:170.—According to Sargent, *P. fusca* "grows usually in deep, rich soil in the neighborhood of streams, often forming almost impenetrable thickets of considerable extent, and attains its greatest size in the valleys of Washington and Oregon." The fruit is eaten by Indians. The species suggests *P. Toringo*.



2035. Prairie States Crab—Pyrus Ioensis (× ⅓).

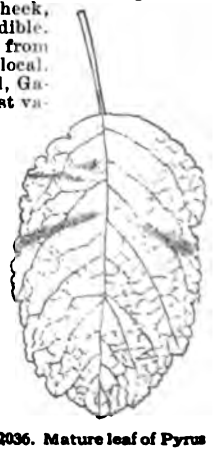
CC. *Calyx persistent.*

15. **coronària**, Linn. Wild Crab Apple. Figs. 2031–34. A low, bushy tree, with very stiff, crooked, thorny branches, the young growth glabrous or becoming so: lvs. triangular-ovate, on the spurs short-ovate, sharply cut-serrate and more or less prominently lobed and notched, thin and hard, on slender but stiff, glabrous petioles: fls. appearing with the lvs., rosy red or blush and very fragrant, on long and slender (1½ to 2 in.), stiff pedicels which are glabrous or nearly so: fr. about an inch in diam., flattened at both ends, clear yellowish green without spots or dots and often with a tinted cheek, the stem very slender and smooth and set in a regular and uniform shallow cavity, the basin (at the apex) broad but rather deep with separated corrugations and a small, smooth calyx, the flesh hard, sour and acerb. Wild in dryish glades and rich uplands from Ontario and New York to District of Columbia, west to Kansas and Missouri, and southward. B.M. 2009. B.R. 8:651. S.S. 4:167. R.H. 1884, p. 104. Gn. 29, p. 395; 34, p. 206.—The fruit, which is produced in abundance, was often buried by the early settlers for use in the spring, when its acerbity was largely extracted; and it was sometimes used for cider. It is also useful for jellies and preserves. The species was probably never introduced into cultivation for its fruit, although it has been long grown for ornament and under domestication the Apples are often twice their natural size. There is a form with semi-double fls. and one (var. *aucubæfolia*) with variegated leaves. An attractive species.

16. **angustifòlia**, Ait. (*P. coronària*, var. *angustifòlia*, Wenzig. *Màlus angustifòlia*, Michx. *M. sempérvirens*, Desf. *M. microcárpa sempérvirens*, Carr.). Lvs. lance-oblong, crenate-serrate or almost entire, not lobed, thick and half evergreen: otherwise very like *P. coronaria*. Western Pa. to Fla. and La., taking the place of *P. coronaria*. B.R. 14:1207. Carrière, "Pom. Microcarpes," pp. 21, 137. S.S. 4:169. R.H. 1877:410?—A double-fld. form of what appears to be this species is figured in G.C. III. 13:43.

17. **Ioénsis**, Bailey (*P. coronària*, var. *Ioénsis*, Wood). Prairie States or Western Crab-Apple. Fig. 2035. Small tree, with mostly softer wood; the parts gray-woolly: lvs. ovate-oblong to elliptic-obovate, irregularly and mostly bluntly toothed and the larger ones marked with right-angled notches of shallow lobes, very tomentose below or becoming rusty and rarely glabrate with age, the petioles short and stout and pubescent: fls. usually upon shorter pedicels which, like the calyx, are tomentose: fr. oblong or at least never flattened lengthwise, sometimes angular, larger than in the last and clinging later to the tree, dull heavy green with numerous light-colored dots on the skin, the surface having a greasy feel, the stem short and thick as compared with No. 15 and set in an oblique cavity, the basin narrow and shallow, with variable corrugations and a closed and pubescent calyx, the flesh sour and austere. Wild in low or flat lands in the Mississippi valley. S.S. 4:168 (frs. too flat).—Fruits appropriated by the settlers, but the species is probably not in cultivation for its fruit, although a double-flowered variety has been lately introduced,—Bechtel's Crab, sometimes referred to *P. angustifolia* (G.C. III. 25:397).

18. **Soùlardi**, Bailey. Soulard Crab. Figs. 2036, 2037. Natural hybrid of *P. Malus* and *P. Ioensis*: a small tree, with much the look of an Apple tree, and woolly: lvs. large, round-ovate to elliptic-ovate or oblong-ovate, either rounded or tapering at the base, often very blunt or even rounded at the top, mostly bluntly and coarsely serrate or dentate when young, irregularly crenate-dentate at maturity, with a tendency to become lobed, on short pubescent petioles, thick and often rugose and woolly beneath: fls. blush, in close woolly clusters like those of the Apple: fr. often 2 in. or even more in diam., flattish lengthwise, yellow and often with a tinted cheek, the basin shallow, flesh fairly edible. Wild in the Mississippi valley from Minnesota to Texas, but always local.—Named for James G. Soulard, Galena, Ill., who introduced the first variety to cultivation. In some forms the leaves become nearly smooth late in the season and there is little tendency towards an irregular notching or lobing of the margins. The tree is hardy and the fruit keeps well and is useful for culinary purposes. A few named varieties are grown in the upper Mississippi valley, where trees of great hardiness are demanded. For accounts of the pomological offshoots of our native Apples, see Bailey, "Evolution of our Native Fruits," and Craig & Hume, "Native Crab Apples and their Cultivated Varieties," Iowa Acad. Sci. 1899.



2036. Mature leaf of Pyrus Soulardi (× ⅓).

19. The above sketch (Nos. 6 to 18) accounts for all the apple-like species known to be in the American trade, although there may be other Latin names in some of the catalogues. There are few remaining species of the Malus section.—*P. cratægifòlia*, Targ., considered by some writers to be of this section, by others to belong to Sorbus, and by still others to be a hybrid between Pyrus and Sorbus, is a bush or small tree, local in N.

2037. Pyrus Soulardi (X ½).

Italy: lvs. broad-ovate in outline, with several sharp lobes: fls. white, about 1 in. across, in open terminal corymbs: fr. ⅓ in. loug, elliptic-oblong, red. B.M. 7423.—*P. Sikkiménsis*, Hook. f. "Very similar to P. baccata, but the leaves (which attain 5 x 3 in.) are more acutely serrate, woolly beneath and on the petiole and on the midrib above, the peduncles and calyx are also woolly. * * * I suspect it will prove a form of P. baccata." —Hooker. Himalayas, 7,000–10,000 ft altitude. B.M. 7430. G.M. 41:313.

L. H. B.

PYXIDANTHÈRA (Greek, *box* and *anthera;* the anthers open transversely like the lid of a box). *Diapensiàceæ*. The PYXIE, FLOWERING MOSS or PINE-BARREN BEAUTY is a pretty little creeping plant, native only to New Jersey and North Carolina, which is covered in early spring with small white, 5-petaled flowers and pink buds. It sometimes blooms side by side with the trailing arbutus. These flowers are sold in the streets of Philadelphia, but the Pyxie is scarcely cultivated. It grows best in moist, sandy soil. In partial shade and soil rich in vegetable mold the buds are pale pink; in full sunlight and poor soil the buds are reddish. The Pyxie belongs to a small family of exceptionally interesting plants remarkable for their beauty, distinctness and geographical distribution. They represent a vanishing race, and there are many different opinions as to their place in the vegetable kingdom. As a genus Pyxidanthera has but one species, and its nearest ally is Diapensia, which differs in having the anthers opening longitudinally; also the fls. are peduncled in Diapensia, while in Pyxidanthera each flower is solitary at the end of a short branch. Another peculiar feature of the Pyxie is the sharp point at the end of each anther.

Generic characters: sepals 5, oblong, obtuse, reddish at tip; corolla short-bell-shaped, 5-lobed; lobes obovate, erose, persistent; stamens 5, inserted in the sinuses; staminodes none: ovary 3-celled: ovules many in a cell: capsule loculicidal.

barbulàta, Michx. Creeping shrub, with a long tap-root in the center of the tuft: lvs. narrow, crowded, overlapping, the young ones woolly at the base within, whence the specific name "barbulata." Fls. March to May. B.M. 4592. Mn. 8:33. B.B. 2:583. Gn. 27, p. 209 (from Harper's Mag.).

W. M.

2033. Pyrus coronaria (X ⅔). See No. 15, page 1474.

Q

QUACK GRASS, QUICK GRASS, QUITCH GRASS. See *Agropyrum*.

QUAKING GRASS. Species of *Briza*.

QUAMASH. *Camassia esculenta*.

QUAMOCLIT. See *Ipomæa*.

QUEEN LILY. This name has been proposed for Phædranassa; also for Curcuma; and it has been erroneously used for Strelitzia.

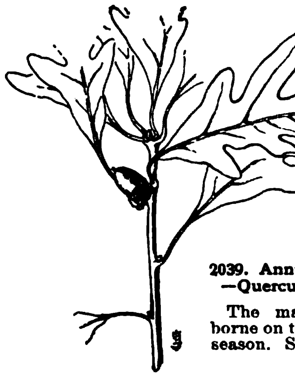
QUEEN OF THE MEADOWS. *Ulmaria pentapetala*; also *Spiræa*.

QUEEN OF THE PRAIRIE. *Spiræa lobata*.

QUÉRCUS (ancient Latin name). *Cupuliferæ*. OAK. Ornamental deciduous or evergreen trees, rarely shrubs, with alternate, petioled, entire or lobed lvs., and inconspicuous monœcious fls., the staminate ones in slender, pendulous, rarely upright, catkins (Fig. 2038); the fruits, or "acorns," consisting of a globular to oblong nut, inclosed or embraced only at the base, or rarely wholly, by a cup-like involucre. The deciduous species are mostly hardy north, while of the evergreen ones none seem to be hardy farther north than Washington, D. C.; some half-evergreen Oaks, like *Q. Turneri* and *Q. Macedonica*, will probably prove hardy in the vicinity of New York. Most of the Oaks are stately trees of noble and majestic habit with stout, wide-spreading branches; some, like *Q. alba, Garryana, Virginiana* and *chrysolepis*, often cover a space more than 100 ft. in diameter; others, like *Q. macrocarpa, Prinus* and *tinctoria*, have a more oval, round-topped head, while *Q. palustris* and *imbricaria* form symmetrical broad pyramids. A very few hardy species are shrubs, generally called Scrub Oaks, as *Q. prinoides* and *Q. ilicifolia*. Oaks rank among our most valuable park and avenue trees, and are as beautiful when grown as single trees as they are when grouped together and forming groves and woods. As avenue trees *Q. palustris, rubra, coccinea, imbricaria* and *Phellos* are among the best, the last-named when medium-sized trees are desired; in the southern states, *Q. laurifolia, uliginosa* and the evergreen *Q. Virginiana* are preferred. The shrubby species, like *Q. prinoides* and *Q. ilicifolia*, may be used for covering rocky hillsides and dry ridges.

2038. Staminate catkins of an Oak—Quercus pedunculata. (× ⅓.) See No. 29.

Oak leaves are always beautiful. They have many shades of green; especially attractive are some with leaves of contrasting colors, the under side being silvery white, the upper one dark green, as in *Q. Muhlenbergi, macrocarpa, Michauxi* and some foreign evergreen species. In many Oaks the leaves show a handsome pink or crimson color when unfolding, and some species assume brilliant autumnal tints. Especially beautiful in autumn are *Q. coccinea* and *palustris*, with the foliage turning brilliant scarlet; *Q. rubra, imbricaria* and *Michauxi*, which turn bright or dark red; *Q. alba*, violet or vinous purple; *Q. lyrata*, scarlet or orange; *Q. Phellos*, pale yellow; *Q. Prinus*, orange or orange-brown; *Q. cuneata* and *ilicifolia*, orange-brown or yellow; *Q. stellata* and *nigra*, brown or dull orange. Some of the foreign species, like *Q. sessiliflora*, and also *pedunculata, Cerris, lanuginosa, glandulifera* and others, retain the green color until late in fall. Besides our native evergreen species, the Japanese *Q. acuta, cuspidata* and *glauca* are among the best evergreen Oaks for cultivation in the South; the European *Q. Ilex* and *Suber* are also handsome evergreen trees.



2039. Annual-fruited Oak —Quercus alba (× ¼).

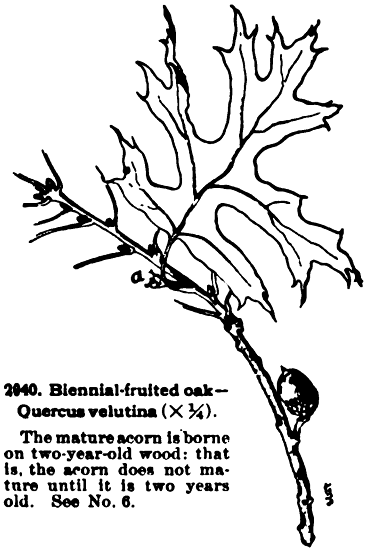
The mature acorn is borne on the wood of the season. See No. 28.

Generally the Oaks grow best in a moderately moist, rich soil, including heavy clay; some, as *Q. bicolor, uliginosa, alba, Phellos, falcata* and *Virginiana*, prefer moister situations and grow naturally in low and often even in swampy ground; while others, especially the Red Oaks, like *Q. rubra, coccinea, imbricaria, Marilandica, Prinus* and *stellata*, grow well in drier, rocky or sandy soil, and the Scrub Oaks on dry and barren soil. The Black and Red Oaks, and especially the Pin Oak, are usually easily transplanted and large trees are moved successfully, while the White Oaks are more particular and only younger nursery-grown trees can be safely transplanted.

Oaks are prop. usually by seeds sown immediately after gathering in fall; this is especially necessary with *Q. alba, Virginiana* and some other White Oaks which sprout as soon as they are ripe; but only the root is produced in fall, while the stem does not appear until the following spring. The seeds of Red and Black Oaks, and also of *Q. pedunculata*, if not sown at once should be stratified and sown early in spring. Acorns should be packed in earth, moss or saw-dust when shipped for a great distance. Varieties are usually grafted on potted stock in the greenhouse in early spring or sometimes in August. As a stock *Q. pedunculata* is preferred, but *Q. rubra, tinctoria* and *Prinus* are also employed. It is probably safer to graft varieties of White and of Red Oak each on stock of the same group. The evergreen species are sometimes increased by layers and also by cuttings.

About 300 species are known, distributed through the colder and temperate regions of the northern hemisphere and in the mountains of the tropics. Almost all species are trees, but sometimes become shrubby in high altitudes or in dry and rocky or sandy localities. Lvs. short-petioled, with deciduous stipules, penninerved: fls. monœcious; the staminate in slender, pendulous or erect catkins with 4-7-parted calyx and 4-12, usually 6, stamens; pistillate in 1-many-fld. spikes in the axils of the young lvs., rarely at the base of the axillary staminate catkins, each flower consisting of an incompletely 3-celled ovary, surrounded by imbricate bracts: fr. a 1-seeded subglobose to oblong nut, surrounded at the base or sometimes almost inclosed by a cup-like involucre.

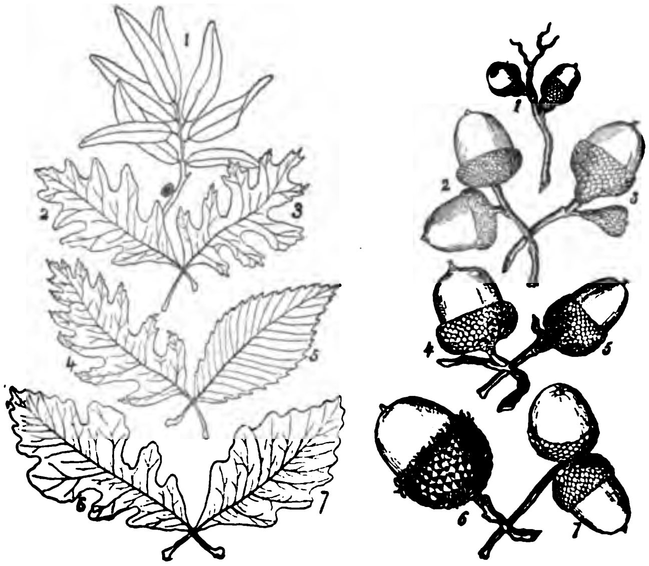
The numerous species have been divided into different subgenera. All American species, except *Q. densiflora*, belong to the subgenus Lepidobalanus (*balanos* is Greek for "acorn"), which is characterized by slender, pendulous, staminate catkins, separate axillary pistillate spikes and a cup consisting of bracts of various shape but not connate into zones. *Q. densiflora* belongs to Pasania, which has erect staminate catkins, some bearing pistillate fls. at their base, like the catkins of Castanea. Cyclobalanus and Cyclobalanopsis have the scales of the cup connate into concentric rings; the inflorescence of the first being similar to that of Pasania, of the second to Lepidobalanus. Chlamydobalanus is much like Cyclobalanus, but the nut is wholly included by the ovate cup. Of Lithocarpus, with the nut partly connate with the cup, but otherwise like the last-named subgenus, no species is in cultivation. The oaks of the subgenus Lepidobalanus are divided into two sections, — Leucobalanus and Melanobalanus. In the former, comprising the White Oak tribe, the acorns mature the first year (Fig. 2039). In the latter, comprising the Black Oaks, the acorns mature the second year (Fig. 2040). Besides the 300 species, about 40 hybrids have been recorded. The latest monograph of the whole genus is by A. DeCandolle in Prodromus, vol. 16, 2, pp. 1-108 (1864-1868). Important illustrated works on American Oaks are A. Michaux, "Histoire des Chênes de l'Amerique" (1801), with 36 plates; Kellogg and Greene, "Illustrations of West American Oaks" (1889), with 37 plates; Sargent, "Silva of North America," vol. 8 (1895), with 82 plates, and Liebmann, "Chênes de l'Amerique tropicale" (1869), with 47 plates. Most of the European and west Asian Oaks are figured in Kotschy, Eichen Europas und des Orients (1862), with 40 colored plates.



2040. Biennial-fruited oak— Quercus velutina (× ¼).

The mature acorn is borne on two-year-old wood: that is, the acorn does not mature until it is two years old. See No. 6.

The Oaks comprise some of the most important forest trees of the northern hemisphere. The wood of most species is strong, tough, hard and durable, and highly valued for many purposes, especially ship-building, construction, for furniture, and in the manufacture of wagons, tools and many other articles. The bark of some species, in America that of *Q. velutina*, *Prinus* and *densiflora*, is used for tanning leather. Cork is obtained from the bark of *Q. Suber* and *occidentalis* in southern Europe. The bark of a few species has also been employed in medicine. The acorns of several species are edible, in America especially those of *Q. Michauxi*, *Emoryi* and *lobata*; in Europe those of *Q. Ilex*, var. *Ballota* and *Ægilops*; in Japan those of *Q. glauca*; in many European countries the acorns of all species are an important food for hogs. In eastern Asia a silkworm feeds on the leaves of different species. A parasitic insect living on *Q. coccifera* in southern Europe and N. Africa yields a scarlet dye. Galls caused by the puncture of certain insects are used for tanning and dyeing and are now chiefly obtained from *Q. Ilex*, var. *infectoria* in western Asia. Some of the above mentioned species are described only in the supplementary list, p. 1483. See *Oak*.



2041. Leaves and acorns of various Oaks.
1, Q. Phellos; 2, Q. alba; 3, Q. velutina; 4, Q. rubra; 5, Q. Prinus; 6, Q. macrocarpa; 7, Q. bicolor.

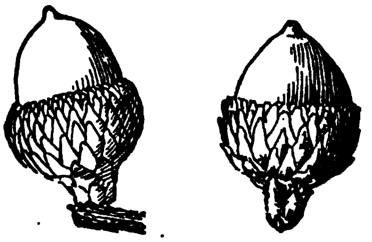
INDEX.

acuminata, 19.
Ægilops, 31 and suppl.
agrifolia, 39.
alba, 28.
ambigua, 2.
aquatica, 9.
Austriaca, 34.
Ballota, 36.
Banisteri, 8.
bicolor, 22.
Bungeana, 14.
Californica, 5.
camata, 32.
Castanea, 19.
Cerris, 34.
Chincapin, 18.
Chinensis, 14.
chrysolepis, 38.
coccinea, 4.
comptonisæfolia, 29.
Concordia, 29.
conferta, 33.
contorta, 29.
crinita, 32.
crispula, 16.
cuneata, 7.
Daimio, 15.
densiflora, 40.
dentata, 15, 17.
digitata, 7.
falcata, 7.
fastigiata, 29.
femina, 29.
ferruginea, 10.
filicifolia, 29.
Fordii, 36.
Garryana, 26.
glandulifera, 17.
grosseserrata, 16.
Hartwissiana, 31.
heterophylla, 29.
Hindsii, 27.
humilis, 18 and suppl.
Hungarica, 33.
Ilex, 36.
ilicifolia, 8.
imbricaria, 12.
Kelloggii, 5.
laciniata, 29, 34.
lanuginosa, 16, 31 and suppl.
laurifolia, 13.
lobata, 27.
lyrata, 24.
macrocarpa, 23.
Marilandica, 10.
Michauxi, 20.
minor, 25.
Mongolica, 16.
montana, 21.
Muhlenbergi, 19.
nana, 8.
nigra, 9, 10.
obtusiloba, 25.
occidentalis, 35.
olivæformis, 23.
palustri-imbricaria, [12.
palustris, 1.
Pannonica, 33.
pectinata, 29.
pedunculata, 29.
pendula, 29, 31, 32.
Phellos, 11.
pinnatifida, 15, 28.
platanoides, 22.
prinoides, 18.
Prinus, 17-22.
Pseudægilops, 31.
pubescens, 31.
purpurascens, 29.
purpurea, 29, 30.
Pyrenaica, 32.
repanda, 28.
Robur, 29, 30.
rubra, 2.
sessiliflora, 30.
stellata, 25.
Suber, 35.
Texana, 3.
tinctoria, 6.
Toza, 32.
uliginosa, 9.
variabilis, 14.
variegata, 29.
velutina, 6.
virens, 37.
Virginiana, 37.

A. *Staminate catkins slender, pendulous: pistillate fls. in separate axillary spikes* (For AA, see species No. 40). LEPIDOBALANUS.
B. *Walls of nut tomentose on the inner surface: lvs. lobed, with bristle-tipped teeth and lobes or entire, bristly-pointed, but not serrate and not evergreen: fr. ripening the second year: bark dark-colored, not scaly.* BLACK OAKS. *Melanobalanus.*
C. *Lvs. pinnatifid, slender-stalked.*
D. *Lobes of lvs. usually toothed: under side glabrous or rarely pubescent.*
E. *Cup shallow, saucer-shaped, broader than high* .... 1. **palustris**
2. **rubra**
3. **Texana**
EE. *Cup turbinate or hemispherical* .... 4. **coccinea**
5. **Kelloggii**
6. **velutina**
DD. *Lobes of lvs. entire or few-toothed: under side whitish or grayish tomentose.* 7. **cuneata**
8. **ilicifolia**
CC. *Lvs. obovate, 3–5-lobed at the apex or almost entire, short-stalked* .... 9. **nigra**
10. **Marilandica**
CCC. *Lvs. oblong or linear-oblong, entire, rarely remotely toothed* ....11. **Phellos**
12. **imbricaria**
13. **laurifolia**
BB. *Walls of nut glabrous on the inner surface* (except Nos. 38, 39): *lvs. sinuately lobed or toothed, not bristle-tipped, rarely serrate with bristly teeth; the evergreen lvs. sometimes entire: fr. ripening the first year* (except Nos. 14, 38, 39). WHITE OAKS. *Leucobalanus.*
C. *Foliage deciduous.*
D. *Lvs. sinuately dentate or serrate.*
E. *Scales of cup linear or lanceolate, spreading and recurved* ....14. **variabilis**
15. **dentata**
EE. *Scales of cup appressed, imbricate.*
F. *Petioles very short: lvs. cordate at base, almost sessile*.........16. **Mongolica**
FF. *Petioles rather slender; lvs. cuneate or rounded at the base.*
G. *Lobes of lvs. acute*..17. **glandulifera**
18. **prinoides**
19. **Muhlenbergii**
GG. *Lobes of lvs. rounded*..........20. **Michauxi**
21. **Prinus**
22. **bicolor**
DD. *Lvs. pinnately lobed.*
E. *Bark separating in thin scales, light gray or light brown. American species.*
F. *Under side of lvs. pubescent or tomentose.*
G. *Length of lvs. 5–8 in.: lvs. lyrate-pinnatifid* ....23. **macrocarpa**
24. **lyrata**
25. **stellata**
GG. *Length of lvs. 2–6 in.*26. **Garryana**
27. **lobata**
FF. *Under side of lvs. glabrous*............28. **alba**
EE. *Bark furrowed and ridged, not scaly, usually dark brown or dark gray. European species.*
F. *Cup with imbricate, appressed scales.*
G. *Lvs. glabrous below.*29. **pedunculata**
30. **sessiliflora**
GG. *Lvs. pubescent below* ....31. **lanuginosa**
32. **Toza**
33. **conferta**
FF. *Cup with elongated, spreading and recurved scales*........34. **Cerris**
CC. *Foliage evergreen, dentate or entire.*
D. *Lvs. whitish, tomentose or tomentulose beneath: fr. ripening the first year*..35. **Suber**
36. **Ilex**
37. **Virginiana**
DD. *Lvs. soon glabrous beneath.*38. **chrysolepis**
39. **agrifolia**
AA. *Staminate catkins erect, partly androgynous, with the pistillate fls. at the base. Pasania*......40. **densiflora**

1. **palústris**, Linn. PIN OAK. Plate XXI. Figs. 1505, 2043. Tree, to 80, occasionally 120 ft., with rather short spreading branches, forming a symmetrical pyramidal head, becoming irregular and oblong in older trees: lvs. deeply pinnatifid, sometimes almost to the midrib; lobes 5–7, oblong or oblong-lanceolate, toothed, separated by wide sinuses, bright green above, light green beneath, with axillary tufts of hairs, 3–5 in. long: fr. short-stalked; acorn subglobose or ovoid, ⅓–½ in. long, embraced about one-third or more by the cup. Mass. to Del., west to Wis. and Ark. S.S. 8:422, 423. Em. 1:167. A.G. 17:213. Gng. 3:129. Mn. 2:155; 6:27.—Handsome tree, especially when young; often used for avenues; grows rapidly and prefers somewhat moist soil; foliage bright red in fall. The tree is fibrous-rooted and transplants well.

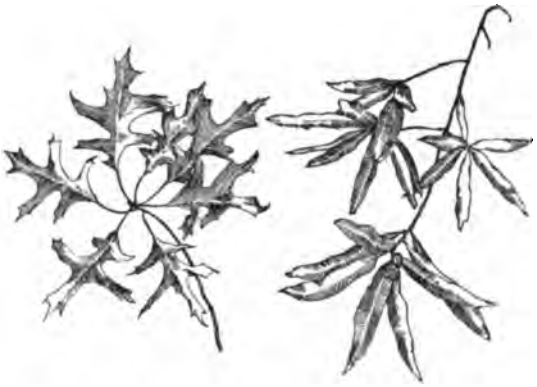
2. **rùbra**, Linn. (*Q. ambigua*, Michx.). Fig. 2041. (4). Tree, to 80, occasionally 150 ft., with stout spreading branches forming a broad, round-topped, symmetrical head: lvs. divided about half way to the middle by wide sinuses into 7–9 triangular-ovate or ovate-oblong lobes, dull green above, light green and pubescent at first beneath, at length glabrous, 5–9 in. long: fr. short-stalked; acorn ovoid, 1 in. long, embraced only at the base by the ¾–1 in. broad cup. Nova Scotia to Fla., west to Minn. and Tex. S.S. 8:409, 410. Em. 1:168. F.S. 17:1812–1813 —Beautiful Oak of rapid growth, growing into a large, majestic tree, with usually broad, round head, the foliage turning dark red in fall.



2042. Acorns of Quercus coccinea (on left) and Quercus velutina. Natural size.

3. **Texàna**, Buckl. TEXAN RED OAK. Tree, attaining 200 ft., with an oblong open head: lvs. almost like those of *Q. coccinea*, with axillary tufts of ferrugineous hairs

beneath, 2–6 in. long: fr. ovoid, ½–1 in. long, embraced about one-third by the deeply saucer-shaped cup. Ind. and Iowa to Tex. and Fla. S.S. 8:411. G.F. 7:515, 517.—Tall tree, only recently introduced into cult.: much like *Q. coccinea* in foliage and like *Q. rubra* in fruit, but the cup somewhat deeper and smaller and pale grayish tomentose.



2043. Quercus palustris (on the left) and Q. Phellos (× ¼).

4. **coccinea**, Muench. SCARLET OAK. Fig. 2042, 2044. Tree, to 80 ft., with gradually spreading branches forming a round-topped rather open head: lvs. deeply divided by wide sinuses into 7–9 rather narrow, oblong or lanceolate, few-toothed lobes, bright green and glossy above, light green and glabrous beneath, 4–8 in. long: fr. short-stalked, ovoid to oblong-ovate, ½–¾ in. long, embraced about one-half by the almost glabrous cup. Me. to Fla., west to Minn. and Mo. S.S. 8:412, 413. Em. 1:163.—Especially valuable for its brilliant scarlet fall coloring; grows well in dryish situations.

5. **Kélloggii**, Newb. (*Q. Califórnica*, Coop.). CALIFORNIAN BLACK OAK. Fig. 2045. Tree, occasionally to 100 ft., with stout spreading branches forming an open, round-topped head: lvs. divided about to the middle by wide sinuses into usually 7 oblong, toothed lobes, pubescent when young, at length glabrous and glossy above, yellowish green and glabrous or floccose beneath, 3–6 in. long: fr. short-stalked; acorn ovoid or oblong, mostly rounded at the top, 1–1½ in. long, embraced about one-third or one-half by the deep hemispherical glabrous cup. Ore. to Calif. S.S. 8:416. G.F. 9:145.

2045. Quercus Kelloggii. (× ½.)

6. **velùtina**, Lam (*Q. tinctòria*, Bartr.). BLACK OAK. YELLOW BARK OAK. Figs. 2040, 2041 (3), 2042. Tree, to 80, sometimes to 150 ft., with rather slender branches, spreading gradually into a narrow, open head; bark very dark brown, inner bark orange: lvs. pinnatifid to or beyond the middle, with 7–9 broad toothed lobes, dark and dull green above, brownish pubescent beneath at first, glabrous at length, except in the axils of the veins, 4–10 in. long: fr. short-stalked; acorn ovoid, ½–1 in. long, embraced about one-half by the hemispherical densely pubescent cup. Me. to Fla., west to Minn. and Tex. S.S. 8:414, 415. Em. 1:160. G.F. 5:55.—Tree of rapid growth, less beautiful than the preceding species, but the wood is more valuable; it flourishes even in rather dry soil, and the foliage turns dull red or orange-brown in fall.

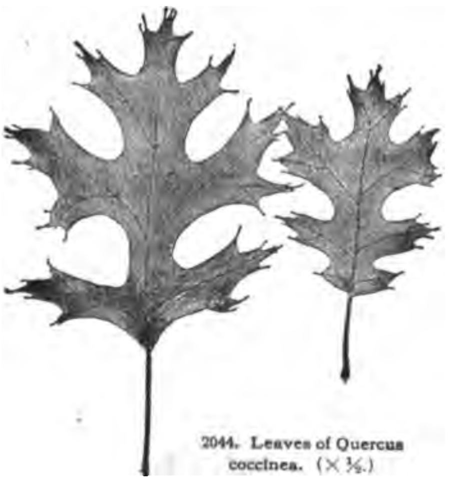
7. **cuneàta**, Wangh. (*Q. digitàta*, Sudw. *Q. falcàta*, Michx.). SPANISH OAK. Tree, to 70, rarely to 100 ft., with stout spreading branches forming an open, round-topped head: lvs. deeply pinnatifid, with 5–7 entire lanceolate and often falcate lobes, separated by broad sinuses, drooping, dark green and glabrous above, tawny or grayish tomentulose beneath, 3–8 in. long: fr. short-stalked; acorn subglobose, ½ in. high, embraced one-half by the turbinate cup. N. J. to Fla., west to Mo. and Tex. S.S. 8:420. G.F. 8:104.—Handsome, with peculiarly distinct foliage, but not quite hardy north.

8. **ilicifòlia**, Wangh. (*Q. Bánisteri*, Michx. *Q. nàna*, Sarg.). BEAR OR SCRUB OAK. Intricately branched, spreading shrub to 10 ft. high, rarely small tree to 20 ft.: lvs. pinnately lobed, with usually 2 broad triangular lobes on each side, dark green and glabrous above, whitish tomentulose beneath, 2–5 in. long: fr. short-stalked; acorn globose-ovoid, ½ in. or less high, embraced about one-half by the saucer-shaped cup. Me. to Va., west to Ohio and Ky. S.S. 8:424. Em. 1:170.—Growing naturally on dry rocky soil and forming dense thickets; it may be used for covering barren rocky ridges and hillsides. Hybrids with *Q. coccinea* and *Q. velutina* are known (Rhodora, 3:24).

9. **nigra**, Linn. (*Q. aquática*, Walt. *Q. uliginòsa*, Wangh.). WATER OAK. Tree, to 80 ft., with rather slender branches forming a conical, round-topped head: lvs. obovate, 3-lobed at the apex or sometimes entire, rarely pinnatifid above the middle, dull bluish green above, paler beneath, soon glabrous except axillary tufts of brown hairs beneath, 1⅓–3 in. long: fr. short-stalked; acorn globose-ovoid, ⅓–⅔ in. high, embraced one-fourth to one-third by the saucer-shaped cup. Del. to Fla., west to Ky. and Tex. S.S. 8:428.—Of rapid growth and easily transplanted; often planted as avenue tree in the South, but not quite hardy north. Usually called *Q. aquatica*.

10. **Marilándica**, Muench (*Q. nigra*, Wangh. *Q. ferrugínea*, Michx.). BLACK JACK. JACK OAK. Tree, to 30, sometimes to 50 ft., with short spreading branches forming a narrow, round-topped or often irregular head: lvs. obovate, 3–5-lobed at the broad apex, with broad, entire or sparingly toothed lobes, glabrous and dark green above, at length glabrous and yellowish green beneath, brownish tomentose at first: fr. short-stalked; acorn ovoid-oblong, ¾ in. high, embraced one-third to two-thirds by the turbinate cup. N. Y. to Fla., west to Neb. and Texas. S.S. 8:426, 427.—Handsome tree, with its large glossy foliage; hardy north. Better known as *Q. nigra*, but this name really belongs to the preceding species.

11. **Phéllos**, Linn. WILLOW OAK. Plate XXI. Fig. 2043. Tree, to 50 ft., sometimes becoming 80 ft., with rather slender branches forming a conical, round-topped head: lvs. short-petioled, linear-oblong, bright green and glossy above, pubescent below when young, glabrous and light green at length, 2–4 in. long: frs. almost sessile, acorn subglobose, ⅓–½ in. high, embraced about one-fourth by the saucer-shaped cup. N. Y. to Fla., west to Mo. and Tex. S.S. 8:435. Gt. 29, p. 221. A.G. 17:195. R.H. 1898, p. 149.—Beautiful hardy medium-sized tree with handsome foliage turning pale yellow in fall, prefers moist or almost swampy soil.



2044. Leaves of Quercus coccinea. (× ½.)

12. **imbricària**, Michx. SHINGLE OAK. Tree, to 60, rarely to 100 ft., with slender and somewhat pendulous

branches, of pyramidal habit in its youth, round-topped when old: lvs. oblong or oblong-lanceolate, dark green and glabrous above, grayish tomentulose beneath, 3–7 in. long: fr. short-stalked; acorn subglobose, ½ in. long, embraced one third to one-half by the turbinate cup. Pa. to Ga., west to Neb. and Ark. S.S. 8:432. A.G. 17:195. Mn. 6:91.—Beautiful Oak of symmetrical habit with handsome glossy foliage, turning russet-red in fall. There are several hybrids of this species and No. 11 with other Black and Red Oaks; one of them is in the trade as *Q. palustri-imbricària*, Engelm.: it has oblong-lanceolate lvs., entire or coarsely toothed, with bristly teeth, soon glabrous, 4–6 in. long: cup turbinate. For other hybrids of this group see S.S. 8:433, 434, 436, 437.

2046. Quercus lobata (× ½). No. 27.

13. **laurifòlia**, Michx. LAUREL OAK. Tree, to 60, occasionally to 100 ft., with comparatively slender branches forming a dense, round-topped head: lvs. oblong or oblong-obovate, sometimes slightly lobed, dark green and shining above, light green and puberulous at first, glabrous at length below, 2–6 in. long: fr. short-stalked; acorn ovoid or subglobose, about ½ in. long, embraced one-fourth by the saucer-shaped cup. Va. to Fla. and La. S.S. 8:429, 430.—Handsome tree with almost half-evergreen glossy foliage, often planted as avenue tree in the southern and Gulf states; not hardy north.

14. **variábilis**, Blume (*Q. Bungeàna*, Forb. *Q. Chinénsis*, Bunge, not Abel). Tree, to 80 ft.: lvs. slender-petioled, oblong to oblong-lanceolate, acuminate, crenately serrate, with bristle-like teeth, dark green and glabrous above, whitish tomentulose below, 3½–6 in. long: fr. almost sessile; acorn subglobose, not much exceeding the large cup; scales thick, lanceolate, recurved. N. China, Japan.—Handsome tree with distinct foliage almost like that of *Castanea crenata*; has proved hardy in Mass. and western N. Y.

15. **dentàta,** Thunb. (*Q. Daìmio*, Hort.). Tree, to 80 ft., with broad, round-topped head: lvs. short-petioled, obovate, sinuately toothed, with 3–6 rounded broad teeth on each side, dark green and usually glabrous above at length, light green and pubescent beneath, firm and leathery, to 12 in. long: fr. almost sessile; acorn ovate, ½–¾ in. long, embraced one-half by the large cup; scales lanceolate, thin, spreading and recurved. Japan.—Remarkable for its large lvs., on young plants to 1 ft. long and 8 in. broad; hardy north. Var. **pinnatifida,** Matsum. (*Q. pinnatifida*, Franch. & Sav.). Lvs. divided almost to the midrib into linear lobes with crisp irregular margins; interesting form.

2047. White Oak (× ¼). No. 28.

16. **Mongòlica**, Fisch. Tree, to 100 ft.: lvs. obovate or obovate-oblong, much narrowed below the middle, coarsely toothed with acute or mucronulate teeth, bright green above, light green beneath, with long hairs along the veins, almost glabrous at length, 3–7 in. long: fr. almost sessile, acorn ⅓–¾ in. high, embraced one-third by the cup. Amurland, N. China, Saghalin.—There are two closely allied species from Japan, *Q. crispula*, Blume, and *Q. grosseserrata*, Blume, which are almost indistinguishable in foliage from each other and from this species, but *Q. crispula* has the cup somewhat deeper, embracing about one-half of the nut. Both have handsome foliage and have proved hardy in the Arnold Arboretum. Under the name of *Q. Mongolica* a form of *Q. lanuginosa* is sometimes found in the trade.

17. **glandulifera,** Blume. Tree, to 40 ft., rarely to 70 ft., shrubby in cult.: lvs. cuneate or rounded at the base, oblong-obovate to oblanceolate, acute, with 6–10 glandular-tipped, acute teeth on each side, light green above, glabrous, whitish or grayish green beneath, appressed silky at first, almost half-evergreen, 2½–5 in. long: fr. peduncled, usually several; acorn ovate, about ½ in. high, embraced one-third to one-half by the cup. Japan.—Half evergreen shrub with handsome foliage, almost hardy north, at least in sheltered positions. Sometimes cult. under the name *Q. dentata*. *Q. glandulifera*, Mast., is *Q. Turneri* (see suppl. list).

18. **prinoides,** Willd. (*Q. Chincapin*, Pursh. *Q. Prìnus*, var. *Chincapin*, Michx.). CHINCAPIN OAK. Spreading shrub, with slender stems, usually not over 6 ft. high, rarely to 15 ft.: lvs. rather short-petioled, cuneate at the base, ovate-oblong or oblong, with 4–8 sometimes obtusish teeth on each side, bright green above, grayish tomentulose beneath, 2½–5 in. long: fr. sessile, acorn oval, about ½ in. long, embraced one-half by the cup. Maine to Ala., west to Minn. and Tex. S.S. 8:378. Em. 1:158.—Pretty shrub for covering dry and rocky ridges. In trade sometimes under the misleading name of *Q. humilis*, for which see supplementary list.

19. **Mühlenbergi**, Engelm. (*Q. Castànea*, Willd., not Née. *Q. acuminàta*, Sarg., not Roxb. *Q. Prìnus*, var. *acuminàta*, Michx.). YELLOW CHESTNUT OAK. Tree, to 100 or occasionally to 160 ft., with rather short branches forming a narrow, round-topped head: lvs. slender-stalked, oblong to oblong-lanceolate, acute or acuminate, coarsely toothed with acute, glandular-tipped teeth, dark or yellowish green above, whitish tomentulose beneath, 4–7 in. long: fr. sessile or short-peduncled; acorns ovate, ¼–¾ in. long, embraced about one-half by the cup. Tenn. to Va., west to Neb. and Tex. S.S. 8:377.—Beautiful tree with light gray bark and handsome foliage, glossy above and silvery white beneath.

20. **Michaùxi**, Nutt. (*Q. Prìnus*, var. *palústris*, Michx.). BASKET OAK. COW OAK. Tree, to 100 ft., with round-topped, rather dense head; bark light gray, scaly: lvs. obovate or obovate-oblong, acute, deeply crenulate-toothed, with obtuse, mucronulate teeth, bright green and shining above, grayish tomentulose beneath, 4–7 in. long: fr. short-peduncled; acorn ovoid, 1–1½ in. high, embraced about one-third by the tomentose cup. Del. to Fla., west to Ind. and Tex. S.S. 8:382, 383.—One of the most beautiful of the Chestnut Oaks; prefers moist soil.

21. **Prìnus**, Linn. (*Q. Prìnus*, var. *montìcola*, Michx. *Q. montàna*, Willd.). CHESTNUT OAK. ROCK CHESTNUT OAK. Fig. 2041 (5). Tree, to 70, or occasionally to 100 ft., with broad, irregular head and dark brown, ridged bark: lvs. slender-stalked, obovate to oblong-lanceolate, coarsely crenulate-toothed, bright or yellowish green above, paler beneath, tomentulose when young, often almost glabrous at length, 5–8 in. long: fr. solitary or in pairs, on peduncles about 1 in. long; acorn ovoid, 1–1½ in. high, embraced about one-third by the cup. Maine and Ontario to Ala. S.S. 8:375, 376. Em. 1:155 (as *Q. Castanea*) and 156. G.C. III. 14:617. G.F. 1:510.—Handsome Oak, growing well in rather dry soil.

22. **bicolor,** Willd. (*Q. platanoides*, Sudw. *Q. Prìnus*, var. *tomentòsa*, Michx. *Q. Prìnus*, var. *discolor*, Michx. f.). SWAMP WHITE OAK. Fig. 2041 (7). Tree, to 70 ft., rarely to 100 ft., with narrow, round-topped, open head and light grayish brown, scaly bark: lvs. obovate to oblong-obovate, sinuately dentate, sometimes lobed half-way to the middle, dark green and dull above, whitish tomentulose beneath, 4–7 in. long: fr. solitary or in pairs on peduncles 1½–4 in. long; acorn ovate-

oblong, 1–1⅛ in. high, embraced one-third by the cup. Quebec to Ga., west to Mich. and Ark. S.S. 8:380, 381. Em. 1:153. G.F. 4:246.—It is less desirable as an ornamental tree than many other species, but the wood is valuable. The light gray bark separating in large thin scales and the numerous small branches which appear on the larger limbs and often on the trunk, make it easy to distinguish from allied species.

23. **macrocárpa,** Michx. BUR OAK. MOSSY CUP OAK. Fig 2041 (6). Tree, to 80, sometimes 160 ft., with large spreading branches, forming a broad, round head; bark light brown, deeply furrowed; younger branches sometimes with corky wings: lvs. obovate or oblong-obovate, lyrate-pinnatifid, with 4–10 pairs of lobes, the lower ones smaller, separated by wide and deep sinuses, the upper ones much larger, or sometimes the lvs. are only sinuately dentate above the middle, bright green and shining above, grayish or whitish tomentose beneath, 4–8 in. long: fr. sessile or short-stalked; acorn broadly ovate or ovoid, ¾–1½ in. high, embraced about one-half by the large ¾–2 in. wide cup, with the upper scales awned and forming a fringe-like border. Nova Scotia to Pa., west to Manitoba and Tex. S.S. 8:371, 372. Em. 1:149. G.F. 2:500; 3:407. Mn. 2:153. Gng. 4:342.—Var. **olivæfórmis,** Gray (*Q. olivæfórmis*, Michx.). Lvs. deeply pinnatifid, lobes almost all narrow and separated by wide sinuses; cup usually elongated, much higher than broad. S.S. 8:373.—The Bur Oak is of vigorous growth and becomes a stately tree and is of picturesque appearance in winter with its corky branches. Crown often fan-shaped until tree is mature.

24. **lyràta,** Walt. OVERCUP OAK. SWAMP, or SWAMP POST OAK. Tree, to 100 ft., with rather small, often pendulous branches forming a symmetrical, round-topped head: lvs. obovate to obovate-oblong, deeply lyrate pinnatifid, with 3–5 pairs of oblong or lanceolate lobes, the lower ones much smaller, separated by a wide sinus from the upper ones, dark green and shining above, whitish tomentulose beneath or sometimes light green and pubescent: fr. short-stalked; acorn globose, ½–1 in. high, almost entirely enclosed by the large scaly cup. N. J. to Fla., west to Mo. and Tex. S.S. 8:374.—Little cultivated; hardy as far north as Massachusetts; prefers moist soil.

2048. English Oak—Quercus pedunculata. Natural size. No. 29.

25. **stellàta,** Wangh. (*Q. obtusiloba*, Michx. *Q. minor*, Sarg.). POST OAK. Tree, to 60, rarely to 100 ft., with broad, dense, round head, and with grayish brown, deeply fissured bark: lvs. short-stalked, broadly obovate, lyrate-pinnatifid, with 2 or usually 3 pairs of lobes, the middle pair being much larger, undulate, and mostly with a lobe on the lower side, separated from the lower pair by wide, from the upper pair by narrower sinuses, dark green above, brownish tomentulose beneath, 5–8 in. long: fr. almost sessile; acorn ovoid, ¾ in. high, embraced one-third to one-half by the cup; scales lanceolate, loosely appressed. Maine to Fla., west to Mich. and Tex. S.S. 8:368, 369. Em. 1:151.—Hardy and handsome tree with dense round head, growing naturally in rather dry, sandy or rocky soil.

26. **Garryàna,** Dougl. OREGON OAK. Tree, to 80, rarely to 100 ft., with wide-spreading branches, sometimes shrubby; bark light gray: lvs. obovate, pinnatifid, with broad, obtuse, entire or toothed lobes, dark green above, pubescent and yellowish green or whitish below: fr. short-stalked; acorn ovoid, about 1 in. high, embraced about one-third by the saucer-shaped cup; scales usually thin. Wash. and Ore. to Calif. S.S. 8:364, 365. G.F. 7:495.—The most important Oak of the Pacific states as a timber tree.

27. **lobàta,** Née (*Q. Hindsii*, Benth.). VALLEY or WEEPING OAK (WHITE OAK of the Pacific states). Fig. 2046. Tree, to 100 ft., with great, wide-spreading limbs and slender drooping branches: lvs. oblong or obovate-oblong, with 3–5 pairs of sometimes lobed-dentate lobes, dark green and stellate-pubescent above and usually whitish tomentulose beneath, 2–4 in. long: fr. almost sessile; acorn elongated, conical, 1½–2 in. high, embraced about one-third by the cup; lower scales tuberculate, upper one subulate. Calif S.S. 8:362. G.F. 3:611; 10:55, 202, 205.—Graceful wide-spreading tree, but has not been cult. successfully outside of Calif.

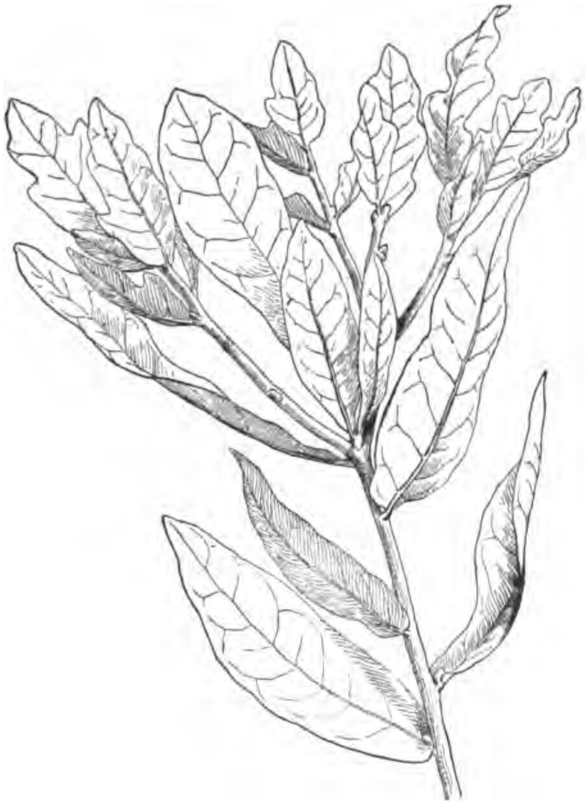
2049. Quercus pedunculata, var. licifolia (× ½). No. 29.

28. **álba,** Linn. WHITE OAK. Plate XXI. Figs. 1506, 2039, 2041(2), 2047. Tree, to 100 ft., with stout spreading branches forming a broad, open head: bark light gray: lvs. obovate or oblong-obovate, narrowed at the base, with 3–8 pairs of rather narrow obtuse and sometimes toothed lobes, pubescent when young, soon glabrous, bright green above, glaucescent beneath: fr. short- or long-stalked; acorn oblong-ovate, 1 in. high, embraced about one-fourth by the shallow cup; scales closely appressed. Me. to Fla., west to Minn. and Tex. S.S. 8:356, 357. Em. 1:145. G.F. 3:91; 4:6, 7; 5:259, 450.—The White Oak is one of the noblest trees of the northern states and a beautiful park tree, where space can be allowed for its full development; the foliage assumes a beautiful deep vinous red or violet-purple color in fall. Var. **repánda,** Michx., is a form in which the lvs. have rather shallow sinuses and the fruits are usually short-stalked. Var. **pinnatifida,** Michx., has the lvs. deeply pinnatifid with narrow often lobed or toothed lobes and the fruits usually slender-stalked. S.S. 8:358. Hybrids of this species with *Q. macrocarpa*, *Prinus* and *stellata* are known. S.S. 8: 359–361. A tree of the hybrid with *Q.*

2050. Acorn of Live Oak—Quercus Virginiana; oftener known as Q. virens (× ½). No. 37.

Prinus was found in the nursery of John Saul, near Washington, D. C., and has been distributed as Saul's Oak.

29. **pedunculàta**, Ehrh. (*Q. Ròbur*, var. *pedunculàta*, DC. *Q. Ròbur*, Linn., partly. *Q. fémina*, Mill.). Figs. 2038, 2048. Tree, to 120 ft., with stout spreading branches forming a broad round-topped head: lvs. short-petioled, auriculate at the base, oblong-obovate, with 3–7 rounded lobes on each side, quite glabrous, dark green above, pale bluish green beneath, 2½–5 in. long: fr. 1–7 on slender peduncles; acorn ovate or ovate-oblong, about 1 in. high, embraced about one-third by the hemispherical cup. Eu., N. Afr., W. Asia. G.C. III. 24:201; 25:168. —More than 40 varieties are cultivated in European nurseries and collections; some of the most important are the following: Var. **Concórdia**, Lemaire. Lvs. bright yellow. I.H. 14:537. Var. **contórta**, Hort. A form with twisted branches and crowded lvs. of irregular shape; of slow growth. Var. **fastigiàta**, DC. With upright branches forming a narrow columnar head. G.C. II. 19:179. Of the same habit are var. **fastigiàta cupressoides**, Hort., with narrower lvs. Var. **fastigiàta aùreo-punctàta** with yellowish spotted foliage. Var. **fastigiàta viridis** with lvs. of darker green. Var. **heterophýlla**, Loud. (var. *comptoniæfòlia*, Hort.) with narrow, elongated, slightly or crenately lobed, sometimes almost entire leaves. Var. **filicifòlia**, Lem. (var. *pectinàta*, var. *laciniàta*, var. *asplenifòlia*, var. *douméti*, Hort.). Fig. 2049. Lvs. deeply divided often almost to the midrib in narrow linear lobes, with crisp margins. G.C. II. 14:632. I.H. 1, black figure not numbered opposite plate 33. R.H. 1894, p. 17. Var. **péndula**, Loud. With pendulous branches; a form with more slender and more decidedly weeping branches is var. *Dauvéssei*, Hort. Var. **purpuráscens**, DC. (var. *purpùrea*, Loud.). With the lvs. bright purple when young, becoming almost green at length or as in the forms distinguished as var. **atropurpùrea** and var. **nigra**, Hort., the color is more intense and retained through the whole summer. F.S. 17:1783–84. Var. **variegàta**, Endl. There are a number of variegated forms, but of no great ornamental value; the most cult. are: *albo-variegàta*, *argenteo-picta*, *aureo-variegàta*, *Joreauénsis maculàta*, *tricolor*.



2051. Variation in the leaves of Live Oak. (*Quercus Virginiana.*) No. 37. Nearly natural size.

30. **sessiliflòra**, Salisb. (*Q. Ròbur*, var. *sessiliflòra*, DC. *Q. Ròbur*, Mill.). Similar in habit to the former, but limbs less spreading and head less broad: petioles ½–¾ in. long: lvs. rounded or cuneate at base, obovate or obovate-oblong, with 5–9 rounded lobes on each side, somewhat glossy above, pale and glabrous or slightly pubescent on the midrib beneath, 2½–5 in. long: fr. almost sessile, usually somewhat larger than those of the preceding species. Europe, W. Asia to Persia. A very distinct variety is var. **mespilifòlia**, Wallr., with almost entire lvs. Var. **purpùrea**, Hort., has the lvs. purplish when young.—*Q. sessiliflora* is less common in cult. than the last. Both are usually called English Oak and are often considered as mere subspecies of *Q. Robur*.

31. **lanuginòsa**, Thuill. (*Q. pubéscens*, Willd.). Tree, to 40 ft., but sometimes remaining shrubby: branches tomentose when young: lvs. pinnately lobed or pinnatifid, with 4–8 pairs of obtuse or acute lobes, glabrous above, pubescent or tomentose and grayish green beneath, 2–4 in. long: fr. almost sessile; acorn ovoid, ½–1 in. long, enclosed about one-half by the tomentose cup; scales closely appressed. M. and S. Eu., W. Asia.—A very variable species, often shrubby, growing mostly on dry, rocky and often on limestone soil; the more southern forms of it are tender. Var. **Hartwissiàna**, Dipp. (*Q. Hartwissiàna*, Stev.). Lvs. small, rather acutely lobed, yellowish tomentose beneath. Var. **péndula**, Jacq. (*Q. Ægilops*, var. *péndula* and *Pseudaègilops péndula*, Hort.), with pendulous branches and densely tomentose lvs., resembles the following species and is supposed by some authors to be a hybrid between the two.

32. **Tòza**, Bosc (*Q. Pyrenàica*, Willd. *Q. camàta* and *crinìta*, Hort.). Tree, to 40 ft., with slender branches; branchlets yellowish tomentose: lvs. pinnatifid half way to the middle or more, with rather narrow and acute lobes, pubescent above, yellowish or grayish tomentose beneath, 3–5 in. long: fr. short or long-peduncled; acorn oblong, embraced one-third to one-half by the tomentose cup; scales loosely appressed, rather large. Spain, S. France. Var. **péndula**, Dipp., with pendulous branches.—Somewhat tender north.

33. **conférta**, Kit. (*Q. Pannónica*, Hort. *Q. Hungárica*, Hubeny). Tree, to 120 ft., with gradually spreading branches forming a round-topped, open head; bark rather light brown: lvs. very short-petioled, auriculate at the base, obovate, deeply pinnatifid, with 5–7 pairs of often toothed lobes, dark green and almost glabrous at length, pale and tomentose beneath, 4–7 in. long: fr. short-peduncled; acorn ovoid-oblong, embraced about one-third by the cup; scales rather large, loosely appressed. Italy. S. E. Eu. G.C. II. 5:85.—Pretty Oak with handsome dark green foliage; hardy in Mass. but seems not reliable farther north.

34. **Cérris**, Linn. TURKEY OAK. Tree, to 120 ft., with rather short spreading branches forming a broad pyramidal at length often irregular open head: lvs. oblong or obovate-oblong, pinnatifid, with 3–8 pairs of entire or few-toothed lobes, dark green and somewhat rough above, grayish pubescent or almost glabrous beneath at length: fr. short-stalked, ripening the second year; acorn oblong-ovate, to 1½ in. long, embraced about one-half by the large mossy cup. S.E. Eu., W. Asia. Mn. 3:166. Gn. 27, p. 476, 477.—Handsome Oak with dark green foliage and of pyramidal habit when young, but not quite hardy north. Easily recognized even in winter by the slender subulate scales surrounding and exceeding the winter-buds. Var. **Austriaca**, Loud. Lvs. longer-petioled, less deeply lobed, or almost sinuately dentate with short, acute, entire lobes. For *Q. Austriaca sempervirens*, see *Q. Turneri* in supplementary list. Var. **laciniàta**, Loud. Lvs. deeply pinnatifid, often almost to the midrib divided into narrow oblong lobes. There are hybrids

with *Q. Suber*, for which see *Q. Lucombeana*, in supplementary list.

35. **Sùber**, Linn. CORK OAK. Tree, to 50 ft., with broad round-topped head and thick, deeply furrowed, spongy, elastic bark: lvs. ovate to oblong, rounded or subcordate at the base, remotely serrate, glabrous above, whitish tomentose beneath, 1–3 in. long: fr. short-stalked; acorn ovate or oblong-ovate, ½–1¼ in. high, embraced one-third to one-half by the cup; scales thick, usually with short and often recurved tips. S. Europe, N. Afr.—From this species cork is obtained; it is much cultivated for this purpose in E. India and recently also in California, where it seems to thrive well. *Q. occidentalis*, Gay, seems to differ only by the fr. ripening the second year and by its greater hardiness; its bark is not distinguished commercially from that of the true Cork Oak.

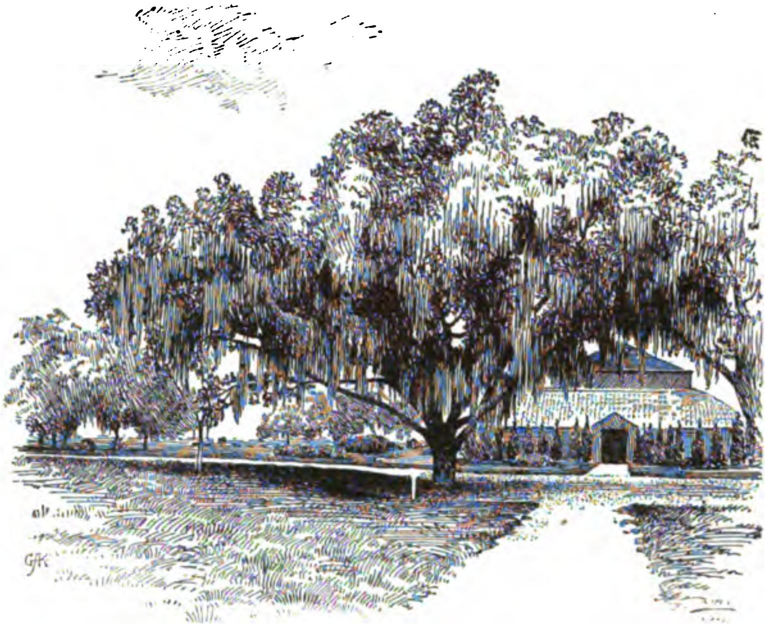
36. **Ìlex**, Linn. HOLLY or HOLM OAK. Tree, to 60 ft., with large, round-topped head; bark not corky: lvs. very variable, ovate to lanceolate, remotely serrate or almost entire and with revolute margin, dark green above, yellowish or whitish tomentose beneath, 1–3 in. long: fr. 1–3, usually peduncled; acorn ovate, embraced about one-half by the cup; scales thin, appressed, rarely slightly spreading. S. Europe. M.D.G. 1898:275. Var. **Ballòta**, DC. (*Q. Ballòta*, Desf.). Lvs. smaller, orbicular or broadly ovate; the sweet acorn is often gathered for food. Var. **Fórdii**, Nichols. (*Q. Fórdii*, Carr.). Of pyramidal habit with narrower and smaller lvs. R.H. 1861, pp. 114, 115; 1885, pp. 352, 353. Not to be confounded with *Q. Fordiana*, Hemsl., a Chinese species with chestnut-like leaves.

37. **Virginiàna**, Mill. (*Q. virens*, Ait.). LIVE OAK. Figs. 2050–52. Tree, to 50 or rarely to 70 ft., with almost horizontal limbs, forming a wide spreading head; sometimes shrubby: lvs. elliptic or oblong, usually entire, with revolute margin, rarely with a few spiny teeth above the middle, dark green and glossy above, whitish tomentulose beneath, 1–3 in. long: fr. peduncled; acorn ovate, about 1 in. long, embraced about one-third by the cup; scales thin, appressed. Va. to Fla., west to Mex. S.S. 8:394, 395. G.F. 1:476; 5:486, 487; 6:7; 8:235. F.R. 1:643. Gng. 8:1.—One of the most beautiful of the American Oaks and much planted as a shade and avenue tree in the southern states; easily transplanted and of rapid growth; also very valuable as a timber tree.

38. **chrysólepis**, Liebm. CALIFORNIA LIVE OAK. MAUL OAK. Fig. 2053. Tree, to 50, rarely to 100 ft., with wide-spreading head and often pendulous branches: lvs. short-petioled, oval to oblong-ovate, acute and spiny-toothed or entire, bluish or yellowish green above, glaucous beneath and covered with fulvous tomentum when young, 1–4 in. long: fr. short-stalked, ripening the second year; acorn ovoid, ½–1½ in. high, embraced about one-fourth by the shallow cup, which is often very thick and densely fulvous-tomentose. Ore. to Calif. S.S. 8:398, 399. G.F. 5:127.—The most beautiful of the Californian Oaks.

39. **agrifòlia**, Née. Fig. 2054. Similar in habit to the former, sometimes shrubby: lvs. broadly oval to oblong, sinuately spiny-toothed, usually convex, dull green above, light green below, pubescent at first, 1½–3 in. long: fr. usually sessile; acorn conic-ovate, often elongated, to 1½ in. long, embraced one-fourth to one-third by the cup; scales thin, slightly puberulous. Calif. S.S. 8:403. P.F.G. 2, p. 44. F.S. 7, p. 138.

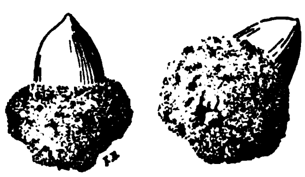
40. **densiflòra**, Hook. & Arn. TAN BARK OAK. Evergreen tree, to 70, occasionally to 100 ft., with spreading branches forming a dense, broad, round-topped head: lvs. oblong-obovate or oblong, acute, remotely dentate, with short acute callous teeth, fulvous-tomentose when young, at maturity glabrous and pale green above, rusty tomentose beneath and finally glabrous and bluish white: fr. peduncled; acorn ovoid or ovate, ¾–1½ in. long, embraced only at the base by the shallow cup coated with linear spreading scales. S. Ore. to Calif. S.S. 8:438. G.F. 5:523.—One of the most beautiful Oaks of the Pacific states. The only representative of the subgenus Pasania in America.



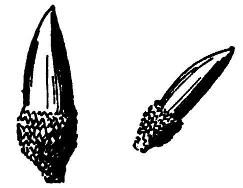
2052. Live Oak, with Spanish moss hanging from the branches.
Audubon Park, New Orleans.—*Quercus Virginiana.*

The species in the following list are not hardy north except when mentioned:

Q. acùta, Thunb. (Q. Buergeri, Blume). Evergreen small tree: lvs. oblong to lanceolate, abruptly acuminate, usually entire, glabrous, light green beneath, 4–7 in.: cup thick, with the scales connate into concentric rings. Jap., Corea. Gn. 19, p. 285.—*Q. Ægilops*, Linn. Evergreen tree, to 60 ft.: allied to Q. Cerris: lvs. lobed-dentate with acute sinuses, fulvous-tomentose at first: cup large, with spreading, flat, lanceolate scales, not much to one-half shorter than acorn. S. Italy, Greece.—*Q. alnifòlia*, Poech. Evergreen shrub: lvs. orbicular or oval, dentate, shining above, yellow-tomentose beneath, 1–2 in. long: cup with recurved lanceolate bracts; acorn 1½ in. long. Creta. Gn. 18, p. 486; 40, p. 95. A.G. 13:436.—*Q. Buérgeri*, Blume = Q. acuta.—*Q. bambusæfòlia*, Fort., not Hance. = Q. Vibrayana.—*Q. brevifòlia*, Sarg. = Q. cinerea.—*Q. castanæfòlia*, C. A. Mey. Half evergreen tree, to 70 ft.: lvs. oblong-lanceolate, serrate, tomentulose beneath, rarely almost glabrous, 4–6 in. long: cup with lanceolate recurved scales. W. Asia to N. Persia. Not or only half-hardy north.—*Q. Cátesbæi*, Michx. Tree, to 60 ft.: lvs. similar to those of Q. cuneata, but rufous-tomentose when young, glabrous at length, except axillary tufts beneath, very short-petioled: cup turbinate. N. C. to Fla. and La. S.S. 8:417.—*Q. Chápmani*, Sarg. (Q. obtusiloba, var. parvifolia, Chapm.). Usually shrub, rarely small tree: allied to Q. stellata: lvs. obovate-oblong and entire or slightly sinuately lobed toward the apex. S. C. to Fla. S.S. 8:370.—*Q. Chinénsis*, Abel. See Q. sclerophylla.—*Q. cinèrea*, Michx. BLUE JACK. Small tree: allied to Q. imbricaria, but lvs. tomentulose beneath, smaller, elliptic to oblong-lanceolate, half-evergreen: cup saucer-shaped; acorn subglobose. N. C. to Fla. and Tex. S.S. 8:431.—*Q. coccífera*, Linn. Evergreen small tree or shrub: lvs. oval to oblong, spinose-dentate, almost glabrous, 1–2 in. long: cup with spreading or recurved rigid scales: maturation biennial. S. Eu.—*Q. cuspidàta*, Thunb. Evergreen tree, to 40 ft., with slender branches: lvs. ovate to oblong, acuminate, crenately serrate toward the apex or entire, glabrous at length, 1½–3½ in. long: fr. in short spikes; cup ovate, enclosing the



2053. Quercus chrysolepis. (× ½.) No. 38.



2054. Quercus agrifolia. (× ½.) No. 39.

acorn. S.Z. vol. I. 2. G.C. II. 12:233. Very desirable evergreen tree of vigorous growth. Var. variegata, Hort. Lvs. smaller, with a broad, irregular, creamy-white margin. G.C. II. 12:233.—*Q. Doùglasi*, Hook. & Arn. Tree, to 60 ft., with dense, round-topped head: allied to Q. Garryana, but lvs. bluish green, less deeply lobed, often only sinuately dentate. Calif. S.S. 8:386.—*Q. dumòsa*, Nutt. Evergreen rigid shrub to 8 ft. or occasionally tree to 30 ft.: lvs. oblong to obovate, entire or sinuately toothed, pubescent, grayish green, ¾-2, rarely to 3 in. long: fr. usually solitary and sessile; acorn oval, ½-1½ in. long, embraced one-third to two-thirds by the cup. Very variable. Calif. S.S.8:392.—*Q. Emoryi*, Torr. Evergreen tree, to 40 ft.: allied to Q. chrysolepis: lvs. usually cordate, oblong-lanceolate, spiny-toothed, soon almost glabrous, 1-2½ in. long: acorn oblong, ½-¾ in. high. Tex. to Ariz. S.S. 8:397.—*Q. Esculus*, Linn. A S. European form of Q. sessiliflora, with the lvs. pubescent when young and deeply pinnatifid: synonym to Q. sessiliflora, var. aurea, DC.—*Q. Fulhaménsis*, Hort. See Q. Lucombeana.—*Q. Gámbeli*, Nutt. Small tree or shrub, very variable: allied to Q. alba: lvs. smaller, pale or yellowish green and usually finely pubescent below: fr. smaller, sessile. Colo. to Utah and Mex. S.S. 8:366, 367. Gt. 44, p. 7.—*Q. Georgiàna*, Curtis. Shrub, 6-8 ft., rarely small tree: allied to Q. palustris: lvs. smaller, less deeply lobed and lobes mostly entire. Ga. S.S 8:425. Hardy.—*Q. glàbra*, Thunb. Evergreen tree: lvs. oblong, obtusely acuminate, entire, glabrous, light green beneath, 3-6 in. long: staminate catkins erect: fr. in spikes, ripening the second year: the oblong nut embraced about one-third by the cup. Jap. G.C. II. 14:785; III. 16:377. R.H. 1858, p. 351. S.Z. vol. I. 89.—*Q. glaùca*, Thunb. Half-evergreen tree, to 40 ft.: lvs. ovate-lanceolate, acuminate, serrate above the middle, glaucous and appressed silky beneath, 2-5 in. long: staminate catkins pendulous, panicled: cup with the scales connate into concentric rings. Jap.—*Q. Gramúntia*, Linn.=Q. Ilex.—*Q. Haàs*, Kotschy. Closely allied to Q. pedunculata: lvs. sparingly stellate-pubescent beneath, larger: fr. larger. E. Eu., W. Asia. Hardy.—*Q. heterophýlla*, Michx. Supposed hybrid of Q. Phellos and Q. velutina: lvs. oblong, narrowed into the petiole, sinuately lobed or toothed or entire. S.S. 8:436.—*Q. hùmilis*, Walt. = Q. cinerea.—*Q. hùmilis*, Lam. Half-evergreen shrub, with oval, coarsely dentate lvs., grayish tomentose beneath: fr. almost sessile. Portugal. Sometimes Q. prinoides is sold under this name.—*Q. incàna*, Roxb. Evergreen tree, to 60 ft.: allied to Q. variabilis: lvs. oblong- to ovate-lanceolate, acuminate, mucronate-serrate, with 14-20 pairs of veins, glossy above, whitish tomentose beneath, 3-6 in. long: fr. sessile; acorn about 1 in. long, at first almost enclosed by the campanulate, rather thin cup. Himalayas. Sometimes united with Q. lanata. Recently advertised by Franceschi.—*Q. infectòria*, Oliv. = Q. Lusitanica, var. infectoria.—*Q. invérsa*, Lindl. = Q. thalassica.—*Q. lanàta*, Wall. Evergreen tree, to 80 ft.: allied to Q. incana: lvs. oblong-lanceolate, with 10-16 pairs of veins, remotely toothed, 4-8 in. long: fr. smaller, cup hemispherical. Himalayas.—*Q. lanuginòsa*, Don = Q. lanata.—*Q. Leàna*, Nutt. Supposed hybrid of Q. imbricaria and velutina: lvs. oblong or obovate-oblong, sinuately toothed or entire, rounded at the base. S.S. 8:434. Hardy.—*Q. Líbani*, Oliv. Half-evergreen shrub or small tree: lvs. oblong-ovate, coarsely serrate, light green and at length almost glabrous beneath, 2-4 in. long: acorn almost wholly enclosed; scales little spreading. Asia Minor. R.H. 1872, p. 155; 1877, p. 173 (not p. 172, which is probably Q. Ægilops). Gn. 1, p. 618.—*Q. Lucombeàna*, Sweet. (Q. Cerris, var. Lucombeana, Loud. Q. Cerris, var. subperennis, DC.). Supposed hybrid of Q. Cerris and Q. Suber. Half-evergreen tree to 70 ft., with broad, round head: lvs. oval-ovate, coarsely serrate, tomentose beneath, 2-3½ in. long: cup with subulate spreading scales. Probably of the same parentage as Q. Fulhamensis, differing by symmetrical pyramidal habit and more corky bark. Gn. 27, pp. 476-478.—*Q. Lusitánica*, Lam. Half-evergreen tree, sometimes shrub: lvs. oval to ovate-lanceolate, coarsely and deeply serrate, pubescent beneath, 1-2 in. long: cup with appressed scales, embracing one-half to one-third of the nut. S. Eu. Var. infectoria, DC., is more shrubby and has the lvs. less pubescent beneath.—*Q. Macedónica*, DC. Evergreen tree or shrub: lvs. oval-oblong, serrate, light green and sparingly pubescent beneath, 1½-3 in. long; cup with the lower scales appressed, the middle ones spreading and the upper ones inversed, almost enclosing the nut. Macedonia, Albania.—*Q. macranthèra*, Fisch. & Mey. Tree, to 50 ft.: allied to Q. conferta: lvs. larger and less deeply lobed, with 8-10 ovate lobes on each side, pubescent, 4-7 in. long. Cauc. to N. Persia. Hardy.—*Q. macrólepis*, Kotschy. A variety of Q. Ægilops, with larger, less deeply lobed lvs. and the scales of the cup large and strongly recurved. Creta.—*Q. oblongifòlia*, Torr. Evergreen small tree, to 30 ft., with spreading, often contorted branches: allied to Q. undulata. Lvs. ovate to obovate, entire or spiny-toothed, glabrous, bluish green, 1-3 in. long: cup embracing about one-third of the ovate nut. Ariz. to Mex. and W. Tex. S.S. 8:388. G.F. 1:140.—*Q. pagodaefòlia*, Ashe (Q. falcata, var. pagodæfolia, Ell.). Tree, to 100 ft., with spreading branches forming an oval or oblong head; closely allied to Q. cuneata: lvs. with 7-11 narrowly triangular lobes, whitish tomentulose beneath. Va. to N. C. to Ga. in swamps.—*Q. phillyræoides*, A. Gray. Evergreen tree or shrub, with broadly oval to oblong-oval lvs., crenately serrate, except at the base, glabrous, 1-2½ in. long: cup with appressed scales, small. Japan.—*Q. Póntica*, Koch. Tree or shrub: lvs. oblong-oval, serrate, glabrous, glaucescent beneath, 4-6 in. long: cup with ovate-lanceolate scales, enclosing about one-half of the nut. Asia Minor. Gt. 40, p. 510. Hardy.—*Q. Pseudosùber*, Santi. Evergreen or half-evergreen tree, allied to Q. Suber: bark less corky: lvs. more deeply serrate, thinner and less tomentose beneath: cup with recurved scales. Italy, N. Afr.—*Q. pùmila*, Walt. (Q. Phellos, var. pumila, Michx. Q. sericea, Willd.). Half-evergreen spreading shrub, to 12 ft., similar to Q. cinerea: lvs. oblong to linear-oblong, entire or coarsely toothed, tomentulose beneath, glabrous at length: acorn subglobose, ½ in. high; maturation annual. N. C. to Fla. S.S. 8:404.—*Q. Pýrami*, Kotschy. Variety of Q. Ægilops, with the lvs. less deeply and very irregularly lobed: cup embracing one-third of the acorn, with the lower scales loosely appressed, the upper ones recurved. Asia Minor.—*Q. reticulàta*, Humb. & Bonpl. Half-evergreen tree, to 30 ft., or shrub: lvs. oval or obovate, spiny-dentate toward the apex, bluish green, tomentose and reticulate beneath, 1-5 in. long: fr. in slender-stalked spikes; cup with appressed scales. Ariz. and N. Mex. to Mex. S.S. 8:390.—*Q. rotúnda*, Hort. = phillyreoides.—*Q. sclerophýlla*, Lindl. Evergreen tree: lvs. oval to oblong-obovate or oblong, acuminate, serrate toward the apex, glaucescent beneath, 2½-6 in. long: fr. in peduncled spikes, nut not much exceeding the cup; bract ovate, appressed. N. China. Paxt. Flow. Gard. 1, p. 37. This is probably the Q. Chinensis, Abel. Sometimes Q. Turneri is cult. under the name of Q. sclerophylla.—*Q. serícea*, Willd. = Q. pumila.—*Q. serràta*, Thunb. Evergreen tree: lvs. obovate-oblong to oblong, acute, serrate, light green and glabrous below, 2-8 in. long: fr. sessile; cup with large, spreading and recurved scales, embracing two-thirds of the nut. Corea, Jap.—*Q. Skínneri*, Benth. Tree, to 70 ft.: lvs. slender-stalked, ovate to ovate-lanceolate, sinuately serrate with bristly teeth, glabrous, 3-6 in. long: fr. sessile; acorn subglobose, large. S. Mex., Guat. G C. 1841:116.—*Q. thalássica*, Hance. Evergreen tree: lvs. elliptic to obovate-oblong, acuminate, serrate toward the apex or entire, glaucous-tomentulose beneath, 3-5 in. long: fr. in short spikes; cup with appressed scales, embracing one-fourth to one-third of the nut. China. P.F.G. 1, p. 36.—*Q. Túrneri*, Willd. Half-evergreen tree: supposed hybrid of Q. Ilex and Q. pedunculata: lvs. oval to obovate-oblong, with 4-8 ascending teeth on each side, light green and almost glabrous beneath at length: frs. few, in peduncled spikes; scales appressed. Of garden origin. Sometimes cultivated under the names Q. glandulifera, Austriaca sempervirens, Pseudosuber and sclerophylla.—*Q. undulàta*, Torr. Small tree or shrub: allied to Q. Douglasi, with smaller, less deeply lobed, bluish green lvs. pubescent below: nut smaller. Colo. to Ariz. and Tex. S.S. 8:385.—*Q. Úngeri*, Kotschy. Variety of Q. Ægilops: lvs. smaller, lobed: cup with recurved scales, not much shorter than acorn. Asia Minor.—*Q. Vibrayàna*, Franch & Sav. (Q. bambusæfolia, Fort., not Hance.). Evergreen tree, to 50 ft., allied to Q. glauca: lvs. lanceolate, serrate, glabrous and glaucous beneath, 3-5 in. long: acorn oblong-ovate, much exceeding the lamellose cup. Jap.—*Q. Wíslizeni*, DC. Evergreen tree, to 80 ft.: allied to Q. agrifolia: lvs. ovate to oblong-lanceolate, sinuately dentate or entire, glabrous, yellowish green beneath, 1-5 in. long: acorn embraced about one-half by the cup. Colo. to Calif. and Tex. S.S. 8:406.

ALFRED REHDER.

QUESNÈLIA. See *Billbergia*.

QUICKTHORN. *Cratægus Oxyacantha*.

QUILLÀJA (from *Quillai*, the Chilean name, which comes from *quillean*, to wash; the bark of the tree contains saponin, an alkaline compound, which makes it useful as soap). *Rosàceae*. A genus of about 4 species of extra-tropical evergreen trees, mostly American: lvs. simple, entire or dentate, shining, coriaceous: fls. axillary and terminal, solitary or clustered; calyx coriaceous, persistent, with 5 valvate lobes; petals 5, small, spatulate; stamens 10: fr. 5, oblong, obtuse, follicles coherent at their bases.

Saponària, Molina. SOAP BARK TREE. A large tree: lvs. 1¼-2 in. long, ovate, shining, dentate, short-petioled: fls. white, about ⅔ in. across, usually terminal, solitary or in clusters of 3-5 on the same peduncle. Chile. B.M. 7568.—Cult. in S. Calif.

QUINCE. Figs. 2055–9. The Quince (see *Cydonia vulgaris*) is an interesting and peculiar fruit. Its commercial status has changed but little in a century. There is no widespread constant demand for the fruit. This has influenced its development; varieties have changed but little and methods of cultivation are generally unstudied. There are a few marked examples which illustrate the advantages of good cultivation, but, unfortunately, the belief that the Quince thrives best when neglected prevails to such an extent that the legitimate profits of the industry are seldom realized. This misconception, coupled with the fact that the fruit of most varieties cannot be eaten raw—though delicious when cooked—has constantly impeded the progress of Quince culture. Times are changing, however. There are several notable Quince orchards in the United States which are being managed like well-conducted dwarf pear plantations. These orchards are profitable. The Quince is peculiar in the manner in which it bears the fruit. The flowers resemble apple blossoms, but are larger and more open, white, shaded with pink, and are produced singly at the extremities of the twigs. The tree is highly ornamental when in flower, and again when decked with irregular golden apple- or pear-shaped fruits the display is of rare beauty.

The habit of growth is slow; the branches are crooked and distorted. The tree rarely exceeds 15 ft. in height, though a specimen at Geneva, N. Y., was reported some years ago to be 30 ft. high, with a stem nearly 2 ft. in diameter. The leaves are oval, entire, dark green above and downy underneath, hanging on late in the autumn. In constitution, it is somewhat less hardy than the apple and pear. Like the apple and pear, the fruit is 5-celled; each cell contains several seeds invested with a kind of mucilaginous pulp, differing in these respects from the apple and pear, which usually have 2 free seeds in each cell. The flavor of the fruit is milder in warm countries than in cold. Though commonly uneatable raw, the Quince has been esteemed for at least 2,000 years for the making of marmalade. Quince marmalade is more freely manufactured in Europe than in America. Quinces are chiefly canned in the United States, although the juice is used in flavoring various manufactured fruit products and in making jelly. Boiled Quinces, served hot with cream or butter and sugar, make an excellent dessert.

2055. Flower of Quince. (× ½.)

It is borne on the wood of the season, not from an autumn fruit-bud.

The best soil for Quinces in New York state is a heavy, moist, retentive clay loam. Contrary to popular notion, it should be well drained. The best orchards are found on lands naturally or artificially drained. Sandy land grows the trees quickly, but they are not long-lived or productive in their later years.

On light soils Quinces may be planted 10 ft. apart each way; on heavy soils, particularly in the East, where the trees are longer lived than in the West, they should not be planted nearer than 15 ft. each way and some persons recommend greater distances. Three-year-old trees are preferred by most planters. The trees begin to bear two years after planting. They reach full bearing at 10 or 12 years. The Quince is shallow-rooted; therefore deep plowing is to be avoided. Thorough tillage is just as necessary as with the peach and plum; adequate fertilizing is also essential to success. The Quince orchard should never be left bare of ground cover in the autumn. A cover-crop (see *Cover-Crops*) is required to protect the roots from frost injury during winter. Frequently the trees are weakened by the loss of surface roots. In selecting cover-crops to obviate this possibility those which can be easily incorporated with the soil by a disk or spring-tooth harrow are preferable. Cow-peas, soy beans or buckwheat, from this standpoint, are desirable plants. Aside from this the trees may need nitrogenous and mineral fertilizers. Their vigor and productiveness may be accepted as guides to the proper fertilizer treatment. If the trees lack vigor, apply barnyard manure, supplement it with mineral fertilizers, as potash and phosphoric acid. These can be broadcasted in the fall or early spring. When readily soluble fertilizers are used they should be applied in smaller quantities during the growing season.

2056. The orange or apple Quince (× ¼).

The natural form of the Quince tree is vase-shaped, or globular with age. Little training is needed. Pruning is of two kinds: that which removes diseased, interfering or superfluous branches and that which influences more directly the quantity and quality of the fruit. The latter consists of "heading-in" strong-growing shoots each year. Heading-in should be performed during late winter or early spring. Whether this system shall be carried on rigidly year after year will depend on the character of the growth. It is also to be remembered that this shortening of the terminal shoots is in effect a thinning process and is of greatest value where trees are growing very rapidly; consequently the extent of its employment is a matter of judgment on the part of the operator. Quinces are remarkably regular bearers, but not infrequently the fruit is ill-shaped and of small size, due to overbearing and insect injury. Heading-in may thus be more satisfactorily used to thin the Quince crop than other pomaceous fruits. As the trees become old, they are likely to grow ragged and to have little bearing wood; heading-in may correct this fault.

Among the most serious fungous diseases are leaf blight, rust and pear blight. Leaf blight (*Entomosporium maculatum*) produces spots on the foliage and fruit. The leaves drop prematurely and the fruit is small and marred by black spots. Rust (*Rœstelia aurantiaca*), a form of the fungus causing the familiar "cedar apple" on wild red cedars is one of the most common diseases, but is of less economic importance than leaf blight. Rust attacks the fruit, blotching it, and in some instances completely enveloping it in a peculiar orange-colored fringe-like growth. The twigs are infested by the mycelium of the fungus, and show its presence by irregular swellings. Leaf blight and rust are best controlled by using Bordeaux mixture. Fire blight or pear blight is the most dangerous disease, because it is always prevalent to a greater or less extent and is very difficult to control. As with the pear, of which it is an enemy of first importance, the only remedy is the hygienic one of preventing infection by destroying the infected part. This must be done promptly. All diseased branches and trees, if badly attacked, should be cut out and burned at once. As a matter of fact, Quinces are not ordinarily attacked in the limbs or on the trunks, so that the removal of the twigs or small branches often cuts out the diseased portions.

2057. Quinces.

The stem of the Quince tree is attacked by borers, which can be controlled only by digging them out. The fruit is attacked by codlin moth; this is best treated with arsenical poisons applied in spray form. The Quince curculio is often very troublesome, causing the fruits to become knotty. The best remedy is to catch the insects by the jarring method (Fig. 2059), as the plum curculio is caught.

Comparatively few varieties have been added to Quince lists in recent years. Bailey says in his bulletin on "The Quince in Western New York" (Bulletin 80 of Cornell Experiment Station), which appears to be the only experiment station publication on this subject, that Orange, Champion, Rea and Meech are the leading varieties in New York state. Among the newer varieties, Fuller and Van Deman should be mentioned. With Quinces, as with other fruits for which there is not a strong and constant demand, it is desirable to plant sufficient variety of early and late kinds to properly cover the season.

The clear yellow and delicate skin of the Quince shows bruises readily. The fruits should be handled carefully. It usually pays to grade the fruit, which may be shipped according to quality in peck or 15-pound grape baskets, in bushel kegs, half barrels or barrels. The finer grades are ordinarily marketed with greatest profit in the smaller packages.

2058. New York Quince plantation.

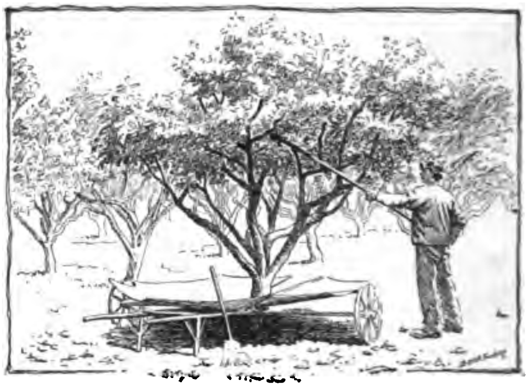
Quinces are propagated in four ways: (1) cuttings of the ripened wood and also from pieces of roots treated like cuttings; (2) mound layers; (3) root-grafting; (4) budding. Hardwood cuttings are employed by nurserymen who have light, warm soils. They are handled like grape cuttings, and made like currant cuttings. In mound-layering the old plant is cut back to encourage a growth of sprouts from the crown. A mound of soil is thrown about them. When rooted they are detached. Layer-grown plants are not the most desirable because much given to sprouting when set in the orchard. When root-grafting is employed, pieces of apple roots are spliced to the cions. These roots assist the cuttings in becoming established, and often are removed when the nursery tree is transplanted at one or two years, or perhaps not till prepared for orchard setting. Quince stock is used when trees are propagated by budding. Angers is commonly grown from seed for this purpose.

John Craig.

QUINCE, BENGAL. See *Ægle.*

QUININE. See *Cinchona.*

QUINOA. See *Chenopodium Quinoa.*


2059. Catching the curculio in a New York Quince orchard.

QUISQUÁLIS (name discussed below). *Combretàceæ.* This includes the Rangoon Creeper, a tender woody plant with 5-petaled red fls., remarkable for their extremely long calyx-tube (2–3 in.), which is slender and green and at first sight might be mistaken for a pedicel or corolla-tube. The name *quisqualis* means literally *who? what?* and was given by Rumphius in astonishment at the plant's behavior, for it is said to grow erect and shrub-like to a height of 3 ft., when it throws out from the base a new growth that climbs up the neighboring trees, after which the original shrub perishes. Many other interesting statements about this plant are made in B.M. 2033.

Quisqualis is a genus of 4 species native to tropical Asia, Natal, Madagascar and Guinea. Lvs. mostly opposite or nearly so, oblong or ovate, acuminate, entire: fls. changeable in color, white to red; stamens 10; ovary 1-celled; ovules 3–4; fr. dry, oblong, leathery, 5-cornered, 5-winged, 1-seeded.

Índica, Linn. Rangoon Creeper. Lvs. 4 in. long, nearly glabrous: calyx-teeth triangular, acute, not acuminate: petals rose or scarlet: fr. with very sharp angles but hardly winged. Malaya. Widely cult. in tropics. B.M. 2033. B.R. 6:492. R.H. 1868:50 (as *Q. pubescens*).—*Quisqualis Indica* is cult. in northern hothouses. For best results it should be planted in beds of soil composed of fibrous loam, peat and sand. The fls. appear from June to September, and last well when cut. After flowering the plant should be cut back severely and water applied less frequently until the wood is ripened. New growth starts the following spring. If the plant is kept in a very hot and humid atmosphere it makes a rampant growth. It is remarkably free from insect pests and fungous diseases. Prop. by softwood cuttings inserted in sand with bottom heat.

Emil Mische and W. M.

Cyclopedia of American Horticulture

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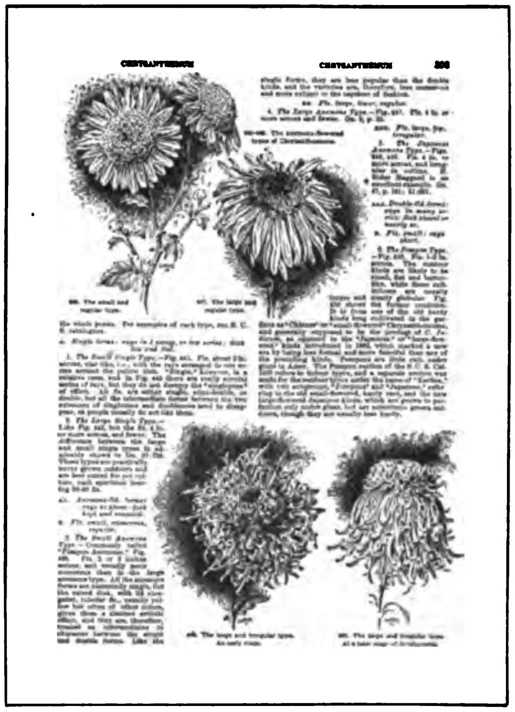
4 VOLS.—OVER 2,000 ORIGINAL ENGRAVINGS

THIS great work comprises directions for the cultivation of horticultural crops and original descriptions of all the species of fruits, vegetables, flowers and ornamental plants known to be in the market in the United States and Canada. "It has the unique distinction of presenting for the first time, in a carefully arranged and perfectly accessible form, the best knowledge of the best specialists in America upon gardening, fruit-growing, vegetable culture, forestry, and the like, as well as exact botanical information. . . . The contributors are eminent cultivators or specialists, and it is expected that the work will include fully 5,000 signed contributions." The arrangement is very systematic, clear and convenient for ready reference.



The Cyclopedia is to be completed in four handsome quarto volumes, embracing about 2,000 pages, with more than that number of original illustrations. It is carefully printed on specially made paper of a permanent character. Vol. I (A to D, 509 pages, 743 illustrations, 9 plates), Vol. II (E to M, 544 pages, 710 illustrations, 10 plates), and Vol. III (N to Q, 432 pages, 606 illustrations, 11 plates) are now ready, and the work will be completed early in 1901.

This book is sold only by subscription, and orders will be accepted for the full set only, at $5 per volume. Terms and further information may be had of

THE MACMILLAN COMPANY
66 Fifth Avenue, NEW YORK

THE GARDEN-CRAFT SERIES

The Horticulturist's Rule-Book

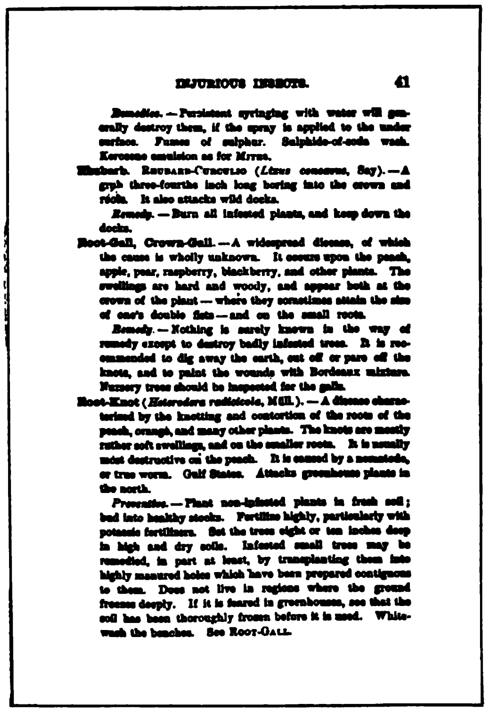
A Compendium of Useful Information for Fruit-growers, Truck-gardeners, Florists, and Others

By L. H. BAILEY

Professor of Horticulture in the Cornell University

FOURTH EDITION — 312 PAGES — 75 CTS.

A VAST mass of information is presented in this handy little reference book, arranged so carefully and indexed so completely that instant reference may be made to any one of the two thousand entries. The things you want to know about horticultural work, the remedy for a plant disease, the way to conquer a troublesome insect enemy — all are concisely set forth. It is a collection of verified and digested facts, in compact form, easy of reference and comprehensive in range. Now in its fourth edition, the book has become a standard reference work.



INJURIOUS INSECTS. 41

Remedies. — Persistent syringing with water will generally destroy them, if the spray is applied to the under surface. Fumes of sulphur. Sulphide-of-soda wash. Kerosene emulsion as for MITES.

Rhubarb. RHUBARB-CURCULIO (*Lixus concavus*, Say). — A grub three-fourths inch long boring into the crown and roots. It also attacks wild docks.

Remedy. — Burn all infested plants, and keep down the docks.

Root-Gall, Crown-Gall. — A widespread disease, of which the cause is wholly unknown. It occurs upon the peach, apple, pear, raspberry, blackberry, and other plants. The swellings are hard and woody, and appear both at the crown of the plant — where they sometimes attain the size of one's double fists — and on the small roots.

Remedy. — Nothing is surely known in the way of remedy except to destroy badly infested trees. It is recommended to dig away the earth, cut off or pare off the knots, and to paint the wounds with Bordeaux mixture. Nursery trees should be inspected for the galls.

Root-Knot (*Heterodera radicicola*, Müll.). — A disease characterized by the knotting and contortion of the roots of the peach, orange, and many other plants. The knots are mostly rather soft swellings, and on the smaller roots. It is usually most destructive on the peach. It is caused by a nematode, or true worm. Gulf States. Attacks greenhouse plants in the north.

Preventive. — Plant non-infested plants in fresh soil; bud into healthy stocks. Fertilize highly, particularly with potassic fertilizers. Set the trees eight or ten inches deep in high and dry soils. Infested small trees may be remedied, in part at least, by transplanting them into highly manured holes which have been prepared contiguous to them. Does not live in regions where the ground freezes deeply. If it is feared in greenhouses, see that the soil has been thoroughly frozen before it is used. Whitewash the benches. See ROOT-GALL.

THE HORTICULTURIST'S RULE-BOOK presents information upon such matters as recipes for insecticides and fungicides, descriptions (with remedies) of insects and diseases, weeds, lawns, grafting-waxes, seed and planting-tables, tables of yields, rules for greenhouse heating and management, with figures, methods of storing produce, tariff and postal rates, rules of societies for naming and exhibiting specimens, score-cards and scales of points, analyses of fertilizing substances, lists of current horticultural books and journals.

"It is packed from cover to cover with a vast amount of useful information for every one who grows fruit, flowers, or plants of any kind. All kinds of useful tables are given, which are very convenient to any one, whether a horticulturist or not." — *California Fruit-Grower.*

THE GARDEN-CRAFT SERIES

Garden-Making

Suggestions for the Utilizing of Home Grounds

By L. H. BAILEY

Aided by L. R. TAFT, F. A. WAUGH, and ERNEST WALKER

FOURTH EDITION—417 PAGES—256 ILLUSTRATIONS—$1.00

HERE is a book literally "for the million" who in broad America have some love for growing things. "Every family can have a garden. If there is not a foot of land, there are porches or windows. Wherever there is sunlight, plants may be made to grow; and one plant in a tin-can may be a more helpful and inspiring garden to some mind than a whole acre of lawn and flowers may be to another." The illustrations are copious and beautiful.

While it presents scientific truths, it is in no sense a mere scientific treatise. It gives in simple language such information as every man or woman who buys a single packet of seed or attempts to grow a single plant is in need of. No other modern American work exists which covers this important field. It forms a manual of instruction for the beginner in garden work, and is at the same time a book of reference for the skilled craftsman. It is profusely illustrated and every important operation is graphically shown.—*Boston Transcript.*

It is impossible to praise too highly the valuable publications issued by Prof. Bailey. This work on "Garden-Making" has all the excellences of his previous books, together with many features which will recommend themselves to every one desiring to make the most of the grounds around his home.—*New Orleans Picayune.*

The Practical Garden-Book

Containing the Simplest Directions for the Growing of the Commonest Things about the House and Garden

By C. E. HUNN

Gardener to the Horticultural Department of Cornell University

and L. H. BAILEY

SECOND EDITION—250 PAGES—MANY MARGINAL CUTS—$1.00

ILLUSTRATED by many marginal "thumbnail" cuts. This is the latest issue of the Garden-Craft series. It is the book for the busy man or woman who wants the most direct practical information as to just how to plant, prune, train, and to care for all the common flowers, fruits, vegetables, ornamental bushes and trees. It has articles on the making of lawns, borders, spraying, fertilizers, manures, lists of plants for particular purposes, hotbeds, window-gardening, etc. It is all arranged alphabetically, like a miniature cyclopedia. It does not contain a bit of theory or of fine writing, but is designed for those who have no time to go into the whys and wherefores, and who want directions as to how to grow plants.

THE GARDEN-CRAFT SERIES

The Nursery-Book

A Complete Guide to the Multiplication of Plants

By L. H. BAILEY

Professor of Horticulture in the Cornell University

THIRD EDITION—365 PAGES—152 ILLUSTRATIONS—$1.00

THE detailed questions of propagation are answered in this admirable volume, which has become the standard work of reference for nurserymen. It is now in its third edition,. and has been thoroughly revised and greatly extended. It is intensely practical, and fully sets forth the processes of budding, grafting, seed-sowing, etc., as well as many other important items of nursery work. It is simply essential to the seedsman, nurseryman, florist or grower of plants in any walk of life. As with all Professor Bailey's works, there are unusually complete indexes and glossaries, rendering the book most convenient in use.

THE NURSERY-BOOK includes Seedage (Requisites of Germination, Seed-Testing, Handling and Sowing of Seeds); Separation and Division; Layerage; Cuttage (General Requirements of Cuttings, Various Kinds of Cuttings); Graftage (General Considerations, Budding, Grafting, Inarching, Grafting Waxes); Nursery Management (Nursery Lands, Grades of Trees, Storing and Trimming Trees, etc.); The Nursery List (an alphabetical catalogue of about 1,500 plants, with directions for their multiplication).

"This book should be in the home of not only every horticulturist, but of every family, irrespective of occupation, who loves flowers or ornamental plants, for it treats of the propagation of these as well as of food plants."—*Michigan Fruit-Grower.*

Plant-Breeding

Being Five Lectures upon the Amelioration of Domestic Plants

By L. H. BAILEY

Professor of Horticulture in the Cornell University

293 PAGES—20 ILLUSTRATIONS—$1.00

A WORK of unique interest, it being the only volume upon this subject. When one considers the marvelous changes in our fruits, vegetables and flowers within a generation, through the work of man in turning to his purposes the impulses of nature, the great interest of this book may be indicated. It tells how varieties of cultivated plants come about, and further, how one may engage in the fascinating work of originating them. The grower who gropes in the dark in his search for the ideal fruit or flower may here find guidance and aid in the principles governing the work.

PLANT-BREEDING comprises five chapters: The Fact and Philosophy of Variation; The Philosophy of the Crossing of Plants; How Domestic Varieties Originate; Borrowed Opinions, being translations from the writings of Verlot, Carriere, and Focke; Pollination, or How to Cross Plants. Chapter III contains the list of fifteen rules for plant-breeding, which De Varginy, the eminent French writer, has called "the quindecalogue of the horticulturist."

THE GARDEN-CRAFT SERIES

The Forcing-Book

A Manual of the Cultivation of Vegetables in Glass Houses

By L. H. BAILEY

Professor of Horticulture in the Cornell University

266 PAGES—88 ILLUSTRATIONS—$1.00

NO subject in horticulture has more rapidly assumed importance than that of bringing into use out of season various vegetables and fruits. If one stops to think of the deprivation there would be, even of the danger to health, in the cessation of this "forcing," and further, if an idea is gained of the extensive business done in out-of-season products, the importance of this complete little manual will be understood. It describes forcing-houses best adapted; tells what crops may be grown and marketed, and how best to do the work. It is a convenient record of long experience and careful experimentation.

The Forcing-Book includes Introductory Suggestions (Category of Forcing Crops, Locations for Vegetable Forcing, Cost of Heat and Labor); Construction of the Forcing-House (Types and Forms of Houses, Structural Details, Heating, Cost); Management of the Forcing-House (Temperature, Soils, Fertilizers, Watering, Ventilating and Shading, Electric Light, Pollination, Insects and Diseases); Lettuce; Cauliflower; Radish; Asparagus and Rhubarb; Miscellaneous Cool Plants (Celery, Salads, Onion, Beets, Potato, Pepino); Tomato; Cucumber; Muskmelon; Miscellaneous Warm Plants (Bean, Eggplant, Pepper, Cyphomandra); Summaries of the Management of the Various Crops.

The Pruning-Book

A Monograph of the Pruning and Training of Plants as Applied to American Conditions

By L. H. BAILEY

Professor of Horticulture in the Cornell University.

THIRD EDITION—545 PAGES—331 ILLUSTRATIONS—$1.50

UNTIL the appearance of this book, there had been no complete and consistent discussion of pruning. Professor Bailey considers fully the philosophy of the subject, showing why we should prune, with such statements of experience and observation as will enlighten the reader. It states principles; and then the various practices of pruning are considered in full detail, and a vast fund of carefully collected data is made serviceable to the reader. The illustrations are numerous and remarkably convincing.

The Pruning-Book includes the Philosophy of Pruning (Does Pruning Devitalize Plants?); The Fruit-bud (The Bud and the Branch, The Leaf-bud and Fruit-bud, The Fruit-spur, Co-terminal Fruit-bearing, Grapes and Brambles, How to Tell Fruit-buds, Summary Synopsis); The Healing of Wounds (Nature of Wound, Suggestions to the Pruner, When to Cut, Dressings, How to Mend Trees); The Principles of Pruning (Top-pruning, Root-pruning, Variation of Habit, Watersprouts, Heading-in, Obstructions, Checking Growth, Girdling, etc., General Law); Some Specific Advice (Form of Top, Root-pruning, Subsequent Treatment, Ringing and Girdling, Pruning Tools, Remarks on Specific Plants); Some Modes of Training, American Grape Training, Vinifera Grape Training.

THE RURAL SCIENCE SERIES

The Principles of Agriculture

A Text-Book for Schools and Rural Societies

Edited by L. H. BAILEY

With Contributions from His Colleagues in the Cornell University

THIRD EDITION — 300 PAGES — 92 ILLUSTRATIONS — $1.25

THIS is an attempt to analyze the complex subject of agriculture, and to present the underlying principles and factors in clear, terse English. Each chapter is in two parts: the first part, or the principles, is in numbered paragraphs in very large type (the size used in "Lessons with Plants"); the second part contains informal suggestions to the teacher and pupil, with illustrations. It is one of the few attempts to coördinate all the various agricultural subjects, showing the relative importance and position of each. It is a skeleton of agricultural science and practice. Full references are made to such literature as the teacher or pupil may be able to secure.

THE PRINCIPLES OF AGRICULTURE comprises the following subjects: Introduction discussing what agriculture is. Part I.— The soil, containing: The Contents of the Soil; The Texture of the Soil; The Moisture in the Soil; The Tillage of the Soil; Enriching the Soil by Farm Resources; Enriching the Soil by Commercial Resources. Part II.— The Plant and the Crop, comprising: The Offices of the Plant; How the Plant Lives; The Propagation of the Plant; Preparation of the Land for the Seed; Subsequent Care of the Plant; Pastures, Meadows, Forage. Part III.— The Animal and Stock, comprising: The Offices of the Animal; How the Animal Lives; The Feeding of the Animal; The Breeding of the Animal; Management of Stock

The Soil

Its Nature, Relations and Fundamental Principles of Management

By F. H. KING

Professor of Agricultural Physics in the University of Wisconsin

303 PAGES — 45 ILLUSTRATIONS — 75 CENTS

A LUMINOUS and practical discussion of the soil and its various attributes. As an understanding of the soil in some measure is of vital necessity to success in even the most limited agricultural operations, the importance of a work like this cannot easily be overestimated.

"IT is a book which progressive farmers will come to regard as one of the essential implements of farm life."— *Boston Daily Advertiser.*

The Fertility of the Land

A Summary Sketch of the Relationship of
Farm-practice to the Maintaining and Increasing of the Productivity of the Soil

By I. P. ROBERTS

Director of the College of Agriculture, Cornell University

THIRD EDITION—421 PAGES—45 ILLUSTRATIONS—$1.25

THIS work, written by one who has been termed "the wisest farmer in America," takes up the treatment of the soil from the standpoint of the farmer rather than that of the scientist. It embodies the results of years of careful experimentation and observation along practical lines, and will be found helpful and inspiring to a marked degree. No other one book could be so heartily recommended to the progressive farmer as this interesting series of talks—for Professor Roberts seems to be personally addressing the reader.

THE FERTILITY OF THE LAND includes A Chat with the Young Farmer; Inventory of the Land; Evolution of the Plow (fully illustrated); The Means and Philosophy of Tilling the Land (telling how and why we should plow, harrow, etc.); Conserving Moisture; Irrigation and Drainage; Manures (in four unique, illustrated chapters); Nitrogen; Potash and Phosphoric Acid; Lime and other dressings; Commercial Fertilizers; The Use of Clovers, Fallows and Rotations; Appendix.

"In short, the book will be found helpful to the farmer, in that it will enable him to go through the routine of his everyday work with intelligence, and. therefore with skill and the assurance of wider success."—*Garden and Forest*

The Spraying of Plants

A Succinct Account of the History, Principles and Practice of the
Application of Liquids and Powders to Plants for the Purpose of Destroying Insects and Fungi

By E. G. LODEMAN

Late Instructor in Horticulture in the Cornell University

399 PAGES—92 ILLUSTRATIONS—$1.00

IN these days this subject is conceded to be of enormous importance to the horticulturist; for it is only by intelligent spraying that many large fruit interests are saved from utter extinction. Professor Lodeman treats the subject both historically and practically, and the work forms the only complete manual of spraying, being admittedly the standard authority. Not only is spraying discussed in its relations to the plant or tree and the crop, but the diseases and insects which are to be combated are most fully presented.

THE SPRAYING OF PLANTS includes in its first part a complete history of the rise of spraying, both in this country and abroad. There are also full illustrated accounts of pumps and nozzles, complete recipes of formulas, and the like. The second part, comprising 135 pages, entitled "Specific Directions for Spraying Cultivated Plants," is an alphabetical illustrated account of the various insects and fungi, with methods of treating them.

"Mr. Lodeman has gathered the results on an immense amount of experiments, both in Europe and America, and his book can be trusted not only as a manual of practice, but as a true and well-classified record of our knowledge on this subject at the present time."—*Garden and Forest.*

THE RURAL SCIENCE SERIES

Bush-Fruits

A Horticultural Monograph of
Raspberries, Blackberries, Dewberries, Currants, Gooseberries, and other Shrub-like Fruits

By FRED W. CARD
Professor of Horticulture in Rhode Island Agricultural College

SECOND EDITION — 537 PAGES — 113 ILLUSTRATIONS — $1.50

THE aim of this book is twofold,— to give all necessary instruction on the cultivation of the bush-fruits, and to provide a cyclopedia of reference to varieties, species, insects, and diseases. Every variety of the various fruits is fully described, this being the first effort to collect all information about varieties of all these fruits since the time of the Downings. In this respect, the book will always be a standard authority. The varieties are arranged alphabetically under various natural classes or groups, but a very full index refers instantly to any variety. The cultural directions are full and clear, and are entirely separated from the descriptions and technical matter. Full instructions are given for the evaporating of berries. The author has himself had long experience in the growing of the fruits. The book is, therefore, both a manual of practice and a work of reference, and is supplied at the usual price of either one alone.

The Principles of Fruit-Growing

By L. H. BAILEY
Professor of Horticulture in the Cornell University

THIRD EDITION — 516 PAGES — 120 ILLUSTRATIONS — $1.25

THERE have been manuals and treatises on fruit-growing, but this volume is the first consistent presentation of the underlying principles affecting the growth of the various fruits. It is thus unique, and it occupies a field of the greatest importance. It joins science and practice, for it not only discusses the reasons for certain operations, but presents the most approved methods, gathered from the successful fruit-growers of America. It appeals especially to the horticulturist who is willing to have his brain direct and supplement the work of his hands, and to acquire a knowledge of principles rather than a mere memorandum of their application.

THE PRINCIPLES OF FRUIT-GROWING includes: Introductory Discussion, comprising an inventory and classification of fruits, the fruit zones, the outlook for fruit-growing; the Location and its Climate, with a full discussion of frosts; the Tilling of Fruit Lands; the Fertilizing of Fruit Lands; the Planting of Orchards; Secondary care of Orchards; Diseases, Insects and Spraying; Picking and Packing and Storing Fruits, Shipping, etc.; and a bibliography of American writings on the subject.

"The book is very practical in its treatment of the subject of fruit-growing, after a brief introductory entering at once into the discussion of the location of the orchard, following that with the tillage of fruit lands, dealing with the planting and care of fruits. Taken all in all, it is the most complete book on fruit-growing at a small price we have seen."— *Western Rural.*

Fertilizers

The Source, Character and Composition of Natural, Home-Made and Manufactured Fertilizers; and Suggestions as to their Use for Different Crops and Conditions

By EDWARD B. VOORHEES

Director of the New Jersey Experiment Stations, and Professor of Agriculture in Rutgers College

SECOND EDITION—335 PAGES—$1.00

THIS book discusses the difficult questions of fertilizers in such plain and untechnical language that those who are wholly unlearned in chemistry can use it. There are no elaborate tables. The book instructs upon the fundamental principles of the use of fertilizers, so that the farmer is able, when he reads it, to determine for himself what his practice shall be. It is not an advocate for commercial fertilizers, but tells simply and directly what the truth is respecting their value.

FERTILIZERS includes the following: The Natural Fertility of the Soil, and Sources of Loss of the Elements of Fertility; The Function of Manures and Fertilizers, and the Need of Artificial Fertilizers; Nitrogenous Fertilizers; Phosphates; Superphosphates and Potash; Miscellaneous Fertilizing Materials; Purchase of Fertilizers; Chemical Analyses of Fertilizers; Methods of Use of Fertilizers; Fertilizers for Cereals and Grasses, Potatoes, Sweet Potatoes, Tomatoes and Sugar Beets; Green Forage Crops; Market-Garden Crops; Orchard Fruits and Berries; Fertilizers for various special crops.

The Farmstead

By I. P. ROBERTS

Director of the College of Agriculture at Cornell University

350 PAGES—138 ILLUSTRATIONS—$1.25

THIS "wisest farmer in America" is also a most delightful and practical writer on the wide subject of farm life and practice. In this book he enters a new field and goes to the root of many problems that have long perplexed farmers and their families. The author's genial style and shrewd, clear, unbiased discussion of such topics as "The Selection and Purchase of Farms," "The Farm as a Source of Income," "Locating the House," "Planning Rural Buildings," "Building the House" (including in three chapters the general plans, outside covering, painting, etc., inside finish, heating and ventilation), "Water-supply and Sewage," "House-furnishing," "The Home Yard," "A Discussion of Barns," etc., will make this book a great favorite in its series, and a great help to all who purchase new farms or remodel old ones. To scores of farm-owners it will be a revelation of how much there is to enjoy on the farm and how to make the most of it.

THE RURAL SCIENCE SERIES

Milk and Its Products

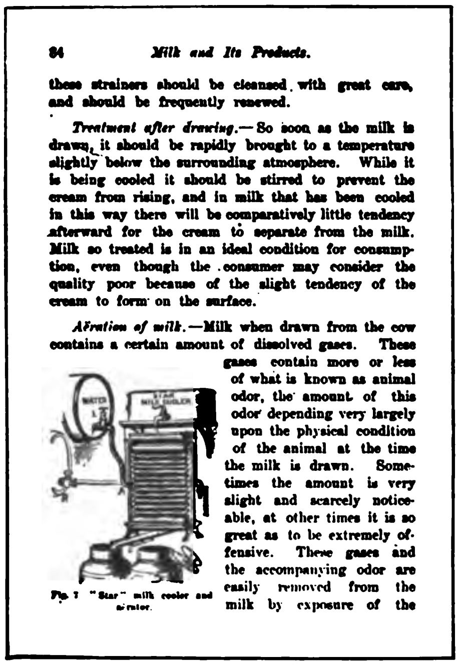
A Treatise upon the Nature and Qualities of Dairy Milk, and the Manufacture of Butter and Cheese

By **HENRY H. WING**

Assistant Professor of Dairy Husbandry in the Cornell University

THIRD EDITION — 311 PAGES — 33 ILLUSTRATIONS — $1.00

IN this volume the whole field of dairying is intelligently considered. The production and character of the lacteal fluid are first discussed, and then in order are taken up the marketing of milk, the production and handling of butter, cheese, and all the products of the dairy. Although the book is up to date in its science, it is none the less a complete guide to modern dairy practice. The illustrations serve to point the practical recommendations of the text. No recent work on dairying has been so well received as this.



84 *Milk and Its Products.*

these strainers should be cleansed with great care, and should be frequently renewed.

Treatment after drawing.— So soon as the milk is drawn, it should be rapidly brought to a temperature slightly below the surrounding atmosphere. While it is being cooled it should be stirred to prevent the cream from rising, and in milk that has been cooled in this way there will be comparatively little tendency afterward for the cream to separate from the milk. Milk so treated is in an ideal condition for consumption, even though the consumer may consider the quality poor because of the slight tendency of the cream to form on the surface.

Aëration of milk.—Milk when drawn from the cow contains a certain amount of dissolved gases. These gases contain more or less of what is known as animal odor, the amount of this odor depending very largely upon the physical condition of the animal at the time the milk is drawn. Sometimes the amount is very slight and scarcely noticeable, at other times it is so great as to be extremely offensive. These gases and the accompanying odor are easily removed from the milk by exposure of the

Fig. 7 "Star" milk cooler and aërator.

MILK AND ITS PRODUCTS includes chapters on: Secretion of Milk; Composition of Milk; Testing of Milk; Ferments and Fermentations of Milk, and their Control; Market Milk; Separation of Cream; Ripening of Cream; Churning; Finishing and Marketing Butter; Milk for Cheese-Making; Cheddar Cheese-Making; Varieties of Cheese; By-Products of the Dairy; Butter and Cheese Factories; Statistics and Economics of the Dairy Industry; Appendix, comprising useful rules and tests, metric system, dairy laws, and references to dairy literature.

"The book is a mine of valuable information, and ought to be in the hands of all progressive dairymen."—*New England Farmer.*

THE RURAL SCIENCE SERIES

Irrigation and Drainage

Principles and Practice of their Cultural Phases

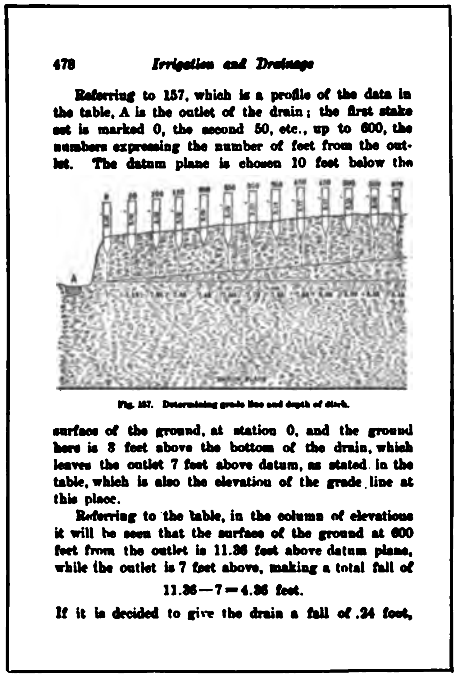
By F. H. KING

Professor of Agricultural Physics in the University of Wisconsin

502 PAGES — 163 ILLUSTRATIONS — $1.50

THIS book deals in a most clear and thorough way with immediately practical problems from the farmer's, fruit-grower's, and gardener's standpoint, while the principles which underlie them are presented in a concise manner that will be most helpful in building up a rational practice of irrigation culture and farm drainage. Special effort has been made all through the book to broaden ideas of general soil management, even where neither irrigation nor drainage is practiced. In the preparation of this book the author personally inspected the irrigating ditches and practices of both humid and arid climates in this country and in Europe, so that the illustrations, which are largely photo-engravings, are also of a most practical nature.

IRRIGATION AND DRAINAGE includes under Irrigation Culture, in Part I: The Extent and Geographic Range of Irrigation; Conditions which make Irrigation Imperative, Desirable, or Unnecessary; The Extent to which Tillage May Take the Place of Irrigation; The Increase of Yield Due to Irrigation in Humid Climates; Amount and Measurement of Water for Irrigation; Frequency, Amount and Measurement of Water for Single Irrigations; Character of Water for Irrigation; Alkali Lands; Supplying Water for Irrigation; Methods of Applying Water; Sewage Irrigation. Part II, Farm Drainage, includes Principles of Drainage, divided into many subheads and treated in a most clear and thorough way; and Practical Details of Under-draining.



478 *Irrigation and Drainage*

Referring to 157, which is a profile of the data in the table, A is the outlet of the drain; the first stake set is marked 0, the second 50, etc., up to 600, the numbers expressing the number of feet from the outlet. The datum plane is chosen 10 feet below the

Fig. 157. Determining grade line and depth of ditch.

surface of the ground, at station 0, and the ground here is 3 feet above the bottom of the drain, which leaves the outlet 7 feet above datum, as stated in the table, which is also the elevation of the grade line at this place.

Referring to the table, in the column of elevations it will be seen that the surface of the ground at 600 feet from the outlet is 11.36 feet above datum plane, while the outlet is 7 feet above, making a total fall of

11.36 — 7 = 4.36 feet.

If it is decided to give the drain a fall of .24 foot,

THE RURAL SCIENCE SERIES

The Principles of Vegetable-Gardening

By L. H. BAILEY

458 PAGES — 144 ILLUSTRATIONS — $1.25

VEGETABLE-GARDENING books are usually mere alphabetic cyclopedias of directions. This book *states the reasons why.* It discusses fully the underlying questions regarding soils, fertilizing, tilling, storing, marketing, controlling insects and diseases, and other vital present-day problems. It treats the general subject of truck-gardening and market-gardening; also the home garden. After these general matters are fully discussed, the treatment of each vegetable is taken up and the principles of its cultivation considered.

The classification is into natural cultural groups, so that it is possible to state all the principles which pertain to any class of vegetables, without much repetition. Thus, root crops are treated by themselves; so are salad crops, bulb crops, and the like. Particular attention is given to hotbeds and coldframes; also to seeds and seed-growing.

Full estimates are given of the capital required for market-gardening. The book contains a complete list of all American books on vegetable-gardening.

ABSTRACT OF CONTENTS

PART I — GENERAL VIEW

Chapter I. The Lay-out of the Plantation.
Chapter II. Glass.
Chapter III. The Soil and Its Treatment.
Chapter IV. Vegetable-Gardening Tools.
Chapter V. Seeds and Seedage.
Chapter VI. Subsequent Management of the Vegetable-Garden.
Chapter VII. Marketing and Storing.

PART II — VEGETABLE-GARDENING CROPS

Chapter VIII. Introductory Discussion.
Chapter IX. Root Crops.
Chapter X. Tuber Crops.
Chapter XI. Bulb Crops.
Chapter XII. Cole Crops.
Chapter XIII. Pot-Herb Crops.
Chapter XIV. Salad Crops.
Chapter XV. Pulse Crops.
Chapter XVI. Solanaceous Crops.
Chapter XVII. Cucurbitous Crops.
Chapter XVIII. Sweet Corn and Okra.
Chapter XIX. Sweet Herbs.
Chapter XX. Perennial Crops.

THE RURAL SCIENCE SERIES

Rural Wealth and Welfare

Economic Principles Illustrated and Applied in Farm Life

By GEORGE T. FAIRCHILD, LL.D.

Ex-President of the Agricultural College of Kansas

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428 THE EVOLUTION OF OUR NATIVE FRUITS

field strawberry in the improvement of the garden varieties has evidently been very small.

A full discussion of this strawberry-evolution is made in Essay XXV., "Survival of the Unlike," and it is, therefore, unnecessary to pursue the subject here.

Fig. 113. Plant of the common wild strawberry, showing how the runners form before the fruit is matured.

It may be said, however, that there are three leading groups or types of strawberries native to North America.—the Scarlet or Virginian group, the Vesca or Old

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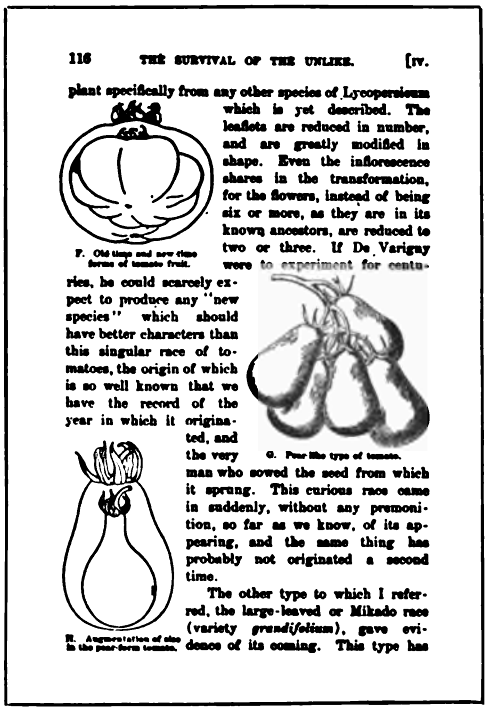

116 THE SURVIVAL OF THE UNLIKE. [IV.

plant specifically from any other species of Lycopersicum which is yet described. The leaflets are reduced in number, and are greatly modified in shape. Even the inflorescence shares in the transformation, for the flowers, instead of being six or more, as they are in its known ancestors, are reduced to two or three. If De Varigny were to experiment for centuries, he could scarcely expect to produce any "new species" which should have better characters than this singular race of tomatoes, the origin of which is so well known that we have the record of the year in which it originated, and the very man who sowed the seed from which it sprung. This curious race came in suddenly, without any premonition, so far as we know, of its appearing, and the same thing has probably not originated a second time.

The other type to which I referred, the large-leaved or Mikado race (variety *grandifolium*), gave evidence of its coming. This type has

F. Old time and new time forms of tomato fruit.

G. Pear-like type of tomato.

H. Augmentation of size in the pear-form tomato.

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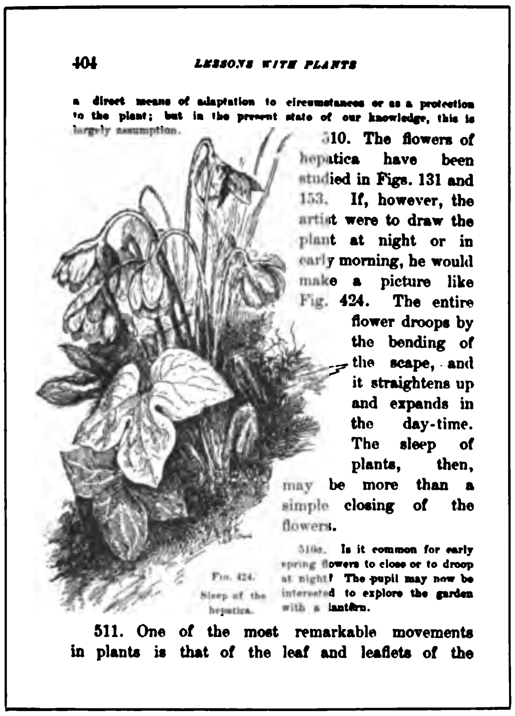

404 *LESSONS WITH PLANTS*

a direct means of adaptation to circumstances or as a protection to the plant; but in the present state of our knowledge, this is largely assumption.

510. The flowers of hepatica have been studied in Figs. 131 and 153. If, however, the artist were to draw the plant at night or in early morning, he would make a picture like Fig. 424. The entire flower droops by the bending of the scape, and it straightens up and expands in the day-time. The sleep of plants, then, may be more than a simple closing of the flowers.

510a. Is it common for early spring flowers to close or to droop at night? The pupil may now be interested to explore the garden with a lantern.

FIG. 424. Sleep of the hepatica.

511. One of the most remarkable movements in plants is that of the leaf and leaflets of the

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